



FRIDAY, MARCH 15.

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Contributions.

The Originator of Emigrant Sleeping Cars.

SAN FRANCISCO, Cal., March 2, 1889.

TO THE EDITOR OF THE RAILROAD GAZETTE:

On page 115 of your issue of Feb. 15, 1889, under heading of "The Pullman Company and Second Class Sleeping Cars," you say: "The original idea of General Manager A. N. Towne, who first furnished," etc. Your informant is in error. One of the civil engineers of the Central Pacific first suggested the idea of emigrant sleeping cars.

L. M. CLEMENT.

Requirements of the M. C. B. Committee on Brake Beams.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The Master Car-Builders' Committee on standard brake gear and standard brake shoe for iron beams stipulates that beams sent to them for test shall not show a deflection of more than one-sixteenth of an inch under a load of 15,000 lbs.

This seems to be a very severe test for any beam, and I doubt if one has yet been made which will stand such a strain without greater deflection, inasmuch as most roads do not apply more than 10,000 pounds to a beam, and even then with a much greater deflection than one-sixteenth of an inch. With the load required by the brake committee the total pressure per car would be 60,000 lbs., in most cases more than the weight of the car, and I think if this load were applied, provided the beams were stiff enough to withstand the strain, the result would be to skid the wheels—which certainly is not desired by the Master Car Builders.

Again as the roads seldom apply a pressure greater than 60 per cent. of the weight of the car, is not the committee's stipulation a trifle exacting?

The matter of expense is an important factor which the committee has apparently overlooked. Granted that a beam can be made to fulfill their requirements, I very seriously doubt if the railroads of this country would be willing to pay the extra cost of a beam which would stand this test.

M. H. W.

Hot Boxes.

ST. LOUIS, March 7, 1889.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The frequent delays to passenger trains caused by hot boxes is one of constant misery to train men and annoyance to passengers. Recently the writer had occasion to travel over a portion of the southern country, and it became necessary, owing to his extended trip and limited time, to make close connections at different points. But, owing to the above-mentioned difficulty of hot-boxes, he was delayed, and at several points missed his connections. These annoyances not only caused delay but expense. At a little town in Tennessee, which is now being "boomed" by real estate agents, backed up by a land company, a stop was made, which lasted 45 minutes. Upon asking the cause of the delay the ubiquitous porter of the sleeping car said we had stopped for the purpose of letting the Yankee passengers see how a "boom" was grown in the south. Stepping from the car, I found the cause of delay—a hot box on the baggage car. It was treated with the usual heroic treatment—pail after pail of water was chucked at the offending journal without any appreciable diminution of energy in its heating power.

Then more grease was added to make it run cool. A run of 20 miles and another stop. When the additional remedy of a change of brasses was suggested to our engineer he would not listen to it, but seemed put out that a passenger should have any ideas of how to cure a hot box. However, to his chagrin he had to put in a new brass and we had no further trouble that day.

In a recent issue of the *Railroad Gazette* I noticed

by the discussions at the Western Railway Club on this subject, that there is a widely diversified opinion among railroad officials upon the causes and cure of this evil. But is it not a fact that most delays to railroad trains caused by hot boxes could be avoided if railroad companies would use a better journal bearing?

Is there not a metal which manufacturers guarantee no hot boxes or no pay? And if so, why do not railroad companies use it and prevent this growing nuisance? In this connection I would like to ask if an accident was ever caused by a hot box?

G. A. H.

Marking the Centre Line and Railroad Property.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Regarding E. F. J.'s inquiry in your issue of Feb. 22 I would say that it is as desirable for a railroad company to monument its property and characteristics as it is for other parties.

Besides securing an inexpensive and durable material as well as locating it so that its position will remain immovable, one of the other principal objects of a surveyor's monument should be to make it as conspicuous and discernible an object as practicable, so that it can be readily found, and for this purpose sawed stone posts 6 in. square, set 4 or 5 ft. deep in the ground and long enough to stand a foot or two out of the ground when not in a roadway, possess more advantages than anything else yet used. Bounds sunken or buried out of sight are proverbially troublesome, not only to keep track of but also to find when wanted.

Burdening a railroad track and its operation with stone post monumenting of such a size as will answer the purpose, whether covered over or left up in sight, is very generally conceded to be an undesirable encumbrance. Frogs and switches have to dodge them; ties have to be spread, twisted about and notched for them; the train hands stumble over them and the trackmen seem to have many reasons for cursing them.

It is conceded that in our Northern climate, frost will penetrate deeper and stronger in and through a railroad bank and ballasting that is kept clean of herbage and exposed on three sides to the weather than in any other place, and when such an action gets hold of these cumbersome stone posts it is sure to raise and twist them about. If the post is between the rails the top of it must be kept broken off by the trackmen, to say nothing about its being an obstruction, or in the way of broken rods and beams, flangers and snow plows. For these considerations monuments between the two rails of a track can be used under the greatest restrictions and only in the most careful way.

The most advisable method under such circumstances is undoubtedly to use old iron fish plates having one end drawn to a point and driven into the ballasting, so that the top of this iron plug will not stick out of the ballast over $\frac{1}{2}$ an inch or so. The old metal value will average less than 10 cents each. They are quickly got, made and put in position. If frost raises them they can be readily driven down with a hammer. When grades are changed it will be found easier to raise or sink them with the work than to dig them up and throw them away.

Defining the location of railroad property involves its right of way, widths along its various adjoiners and its various changes, as well as the characteristics of its original centre line survey. The relations of one to the other are subject to all sorts of contentions, and it is fully as much trouble to locate, keep watch of and care for one as for the other. An intelligent location of the right of way and other adjoining railroad property should not only refer as to how, when and where its title can be found, but its definite and comparative position with the original centre line survey are also important considerations.

Monuments should be erected on each side of the right of way, at all the various adjoiner's corners, and at all places where the alignment of widths changes or is broken. Widths, unless otherwise noted, should be made use of on the basis of their being in a perpendicular direction to the original centre line survey.

Locations thus made and perfected make it one of the simplest of tricks to keep track of and to keep up the real estate department. The advantages from such an operation make it a great satisfaction to all concerned. Adjoiners know their boundaries and limits. Buildings and improvements by private parties will not knowingly be put on the railroad company's property. All encroachments are easily and readily known, and if persisted upon are without any mitigating circumstances. As heretofore suggested, the space between the rails of a used track should be incumbered as little as possible with anything liable to affect its operation, or in appropriately taking care of it, and it is desirable on many accounts that the effective monumenting of a railroad should be placed outside of it as much as possible.

The alignment characteristics will be less liable to get confused with the property boundary monuments if they are of a different material and put in at right angles from the original centre line survey on one particular side. It will also be found to be advantageous to have this right angled distance a multiple of some fixed distance. An even seven feet on a single track railroad is advised; the idea being that an indiscriminate distance is of no value unless it is known just exactly what it is.

The record of all such monumenting should be based upon its following the original centre line survey, and should state the station and pluses as follows:

1. Its various alignment characteristics with reference to the offsets made use of in monumenting.
2. Its various intersections of adjoining boundary lines

and other points where a change in width occurs, with a statement as to the respective width in each case.

3. Its various crossings over roads, streams and dry runs and an abstract of the dimensions and location of its bridging and masonry.

4. Its various frog and switch points with length of side tracks.

5. Its cuts and fills and such natural characteristics as are of interest.

For future reference, checking data and for mapping, the information to be tabulated as above will be found to be worth all the trouble of obtaining it.

NIMROD.

Limitation of the Profits of Railroads.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have been accustomed to look upon the *Railroad Gazette* as an eminently fair and independent paper, but on reading the letter printed on the first page of your issue of March 1 concerning the proposed issue of new stock on the Boston & Albany, I am forced to the conclusion that both you and your correspondent "Judex" are somewhat prejudiced in favor of the railroads. Fairness has been a characteristic of "Judex" heretofore, but he must have forgotten the equities of the circumstances in this case. It is true, no doubt, that the Boston & Albany directors are warranted in giving their chief attention, as directors, to making money. They do not, indeed, run an educational institution. But you do run just such an institution, and for that reason it is to be regretted that you so gently gloss over a transaction which sadly hampers the education of the people in the right direction. You not only run an educational institution, but you should make it a broad and effective one. You should have more primary classes. The daily press, which bears the chief burden of educating the people in all departments, railroad questions included, has a very weak grasp on the matters here alluded to, and it needs a great deal of instruction from journals like yours. Whenever the papers say anything to the point it is on one narrow question. If they undertake anything like a general discussion they quickly run into generalities and platitudes.

The main questions which the Legislature of Massachusetts is trying to grapple with are: 1. Is the Boston & Albany Railroad Company too rich? 2. Should we take measures to restrict its income, and if so, how? There are indications that a majority of the members either hold stock in the corporation or else have near friends who own an interest in it, and that, therefore, they will favor this fat stock dividend in spite of all arguments. But the true principles should be elucidated, nevertheless.

I may remark in passing that it is not exactly fair for you to say that the railroad company indulged in no deception whatever. In the remarks of the company's counsel before the Legislature in applying for the law desired, we find, as reported, a definite allusion to the benefit of changing bonds to stock, because of the promotion of good public policy in saddling the risk of short income in poor years on the stockholders instead of innocent foreign bondholders; but there is no report of any remarks by Mr. Hoar concerning the other half of this fact; that in good years the stockholders would receive all the advantages accruing from large income. On this road all years are good years, and the directors expect this state of things to continue. The reference to the poor years is, therefore, somewhat in the nature of "taffy."

The *Springfield Republican*, in discussing this question, says that the road should be required to reduce its local passenger fares from $2\frac{1}{4}$ cents to 2 cents per mile. The legislature has already added one amendment to the bill, providing that \$1,000,000 must be immediately spent in removing grade crossings of streets and country roads. Are not these good propositions, and should they not be enforced? Judging by the prosperity of the road and the good service it has been able to furnish in other respects fares ought to have been thus reduced five years ago and the million for crossings should have been used before now. It does, indeed, seem somewhat hard for a road to have to suffer because it is prosperous, but we must not forget—certainly a fair-minded person like "Judex" should not forget—that the interests of the public who use the Boston & Albany and who have given it its right of way through the state, are after all paramount to those of a few thousand stockholders. These stockholders may be widows, retired clergymen and all sorts of innocent people, but should the benevolence of the community toward such persons take the form of giving them two or three per cent. higher dividends than they could get on ordinary real estate? And when you come to consider the millionaires, who own the bulk of the stock, why ought not they to put in their money for the proposed improvement and accept 4 per cent. bonds for it? Would that dangerously weaken their interest in the preservation and conduct of the property? they richly deserve ample remuneration for their enterprise in building up such a magnificent property, but have they not received their sufficient reward already in the liberal income afforded by their present investment?

Mention was made of the Chemical Bank affording the same rates as other banks. Why should not such a rich concern be compelled to afford lower rates than others? Perhaps the Boston & Albany ought to be limited to $1\frac{1}{2}$ cents per mile instead of 2 cents. "Judex" says that if the unlimited dividends were permitted, competition would come in to correct any lack in the service. But this is a remedy which works so slowly as to be ineffective in many cases. When will there be a competing line between Springfield and Pittsfield, where a new road would cost \$100,000 per mile, and have only moderate local business? Who will venture to build a new road from Boston to South Framingham, where

land damages would be enormous? The case of the New York, New Haven & Hartford is an illustration. Parallel schemes and Housatonic branches may be proposed from now until doomsday, but the road that can compete with the New Haven cannot amount to anything until \$50,000,000 is expended to get it into New York City, or somewhere near there.

E. F. P.

[We have treated this matter at length in the editorial columns.—EDITOR RAILROAD GAZETTE.]

The Equity of the Mixed Per Diem and Mileage Plan for Settling for Car Service.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In the February number of Sechrist's Railway Equipment Guide it is reported that the Car Service Committee of the Time Convention, while adhering to the mixed system, are about recommending a reduction of the per diem part from 15 to 10 cents per day, leaving the mileage at $\frac{1}{2}$ cent as before. That is, the mixed rate is to be made to approximate closer to straight mileage than it has in practice hitherto. It is to be hoped that this report is premature, and that when the circulars that have been sent out are all in, the committee will hesitate about recommending a plan which in a trial of eleven months last year developed so few elements of popularity and made so few friends as did the mixed mileage and per diem scheme. The large number of practical car service men who believe in the superiority of per diem, pure and simple, have remained very quiet of late, believing, very likely, that no other plan can long meet with favor; but the present seems a proper time to once more compare the mixed system with out and out per diem, and especially to note how far the claim of the inequity of straight per diem is borne out by recent figures on the subject.

It is claimed for straight per diem, and not denied, as far as the writer is aware: 1. That the per diem part of the charge is that which promotes movement and tends to prevent detention. The higher it is, the more effective it is. And it necessarily is higher when wholly per diem, than when divided between per diem and mileage.

2. It being generally admitted that 25 cents per day represents very nearly, if not exactly, the cost of maintenance and renewal per car of the ordinary equipment, it follows that under straight per diem at that rate the car owner is assured of receiving cost for his equipment while on foreign roads; and the car borrower is certain of paying only cost no matter how rapidly he moves cars.

3. It is perfectly easy to check up straight per diem against any road; while it is as impossible to be sure of accurate accounts with the mixed system as with the present straight mileage.

4. It is an incidental advantage that straight per diem entails much less clerical work than the mixed system; probably about 33 per cent.

These advantages of straight per diem are not seriously denied by the advocates of the mixed system, but they claim as against them:

"That straight per diem is in the nature of a penalty not commensurate with the service which the car performs, whereas the mixed plan which pays mileage for the distance that the car travels, and interest on the value of the car while it is away from home, is eminently a fair and equitable method of remunerating the car owners for the value and use of 'the cars.'—(Voorhees. Proc. Time Convention, October, 1888, p. 16.)

It will be noticed that these reasons are largely theoretical, based rather upon what may be supposed to be fair than what actually happens; whereas the real practical question is, which of the systems gives the greatest promise of preventing unnecessary delays, while affording a fair rental to the parties who furnish the cars? Does the mixed plan, in point of fact, remunerate the car owner? Is it, indeed, as fair as straight per diem to the car borrower? It is to the consideration of these points that I would now direct attention.

It must first be observed that 15 cents per day plus $\frac{1}{2}$ cent per mile is just equal to the straight per diem charge of 25 cents, when a car makes 20 miles per day. So we see at once that it is only when foreign cars on any road make less than 20 miles per day that the borrower gets them for less under the mixed plan than under the straight per diem. When they average over 20 miles he pays more than under straight per diem. Not much of an inducement that, one would say, to secure rapid movement. But to completely cover the case we must examine the balances. The rule in this case is equally simple, but requires too long a discussion to be demonstrated here. I must leave it to be worked out by those interested in the subject, each for himself, contenting myself with pointing out that all the figures so far obtained are in exact accordance with it, as I shall show in the sequel. It is this:

Whenever the average miles per day of foreign cars on the borrowing road is greater than the average miles per day of its cars on foreign lines, then it is the interest of such a road to have a straight per diem charge. Vice versa, when the average miles per day of such cars is less on its line than its cars make on foreign roads, then the mixed plan will be more favorable for it.

A slight exception to this rule may be sometimes noted, where the performance on a road, which is a large car borrower, is not very good itself, and is only a little better than on foreign lines. But even here the spirit is true, for a very little better performance on its part will turn the scale in favor of straight per diem. It thus appears that the mixed plan, so far from being equitable, offers a premium for inefficiency. The honest car-owner generally receives less than cost for his cars; the efficient car borrower always pays

more. The advocates of the mixed plan have never pointed out just where the injustice of straight per diem lay, but from the above it would appear that it is unjust and inequitable because it hurts inefficient borrowers. But surely it was just this class that straight per diem was aimed at; and if it acts as a spur on them nobody ought to mourn much.

Under the mileage system the roads detain cars 5, 10, 20, 40, 60 days, or as long as they please, and pay nothing. Under the mixed plan they pay a little, and under the straight plan the actual cost of the car. If we may be allowed the figure in these prohibition times, I would say that straight per diem may be likened to whiskey, straight mileage to water, mixed is then water and whiskey, neither hot nor cold, but lukewarm. It seems a little too strong yet, so the new proposition is to add a little more water.

Mr. Voorhees, from whom we have previously quoted, continues: "As far as the question of expediency is concerned the result of a straight per diem, if we may judge by the figures presented to us by the Association of Car Accountants, would be very greatly in favor of the trunk lines, and lines having long hauls." Now in regard to these figures of the car accountants, it is not likely, from the way he spoke, that Mr. Voorhees made a very close examination of them; he was probably misled by the report of the committee, who, having been appointed to receive and tabulate the figures, took the opportunity, in presenting them to the Time Convention, of making a one-sided report, without the Car Accountants' Association having a chance to revise it. This report, written wholly in the interest of mixed per diem, does intimate that roads having a long haul will make all the money. How far the figures presented bear out the statements of the committee we shall presently see. Here is what the report says. After conceding "that 25 cents per day is an inadequate return to the car owners," it continues: "We would especially commend the mixed plan in preference to the straight per diem." "Straight per diem is not equitable. This fact is demonstrated by an analysis of the large credit balances that would accrue to the Pennsylvania, Erie, West Shore, and other long lines under a straight per diem of 25 cents per day."—(Proc. Time Conv. as above, p. 4.)

Here, now, we have it. Straight per diem is demonstrated (it) to be unjust, because long lines have such large credit balances. Let us then analyze these credit balances and see if anything is shown.* We find it is true that five long roads, including those named, would, under straight per diem of 25 cents, receive \$155,000 per month more than under the present mileage system of $\frac{1}{2}$ cent per mile. Under the mixed plan of $\frac{1}{2}$ cent per mile and 15 cents per day, they would receive \$77,000 more than at present. So under the straight plan they would receive \$78,000 per month more than under the mixed plan.

But what are these credit balances, these large amounts that so startle the committee? Are they not really the losses of the roads in question under the present system? Are they not in fact made up of what they lose by not receiving cost (25 cents per day) for their cars, and paying more than cost for the cars that they borrow? I submit that they are this, neither less nor more. How, then, do they demonstrate that straight per diem is inequitable?

But there is a large credit balance under the mixed plan. Not within \$78,000, it is true, of making the roads whole, but still entirely too much. Why is not the mixed plan inequitable also? Ah, I forgot: The committee is at least consistent. They propose a change; one-half a cent and ten cents will leave only a credit balance of \$48,000 more than at the present mileage rate. But why any at all? Why any change from dear, old straight mileage that works so nicely and lets us keep cars just as long as we want to.

These roads, then, would make \$78,000 per month more under straight per diem than under a mixed plan of one-half a cent and 15 cents. Let us see why. We find that, taken collectively, foreign cars on their lines made 36 miles per day; their cars on foreign roads made 24 miles per day. So, under the mixed plan, they pay 33 cents, and receive 27 cents. Here is the matter in a nut shell: Under mixed per diem they pay 6 cents per car per day more than they receive, while under straight per diem, they receive and pay equal amounts.

Where is the equity of this arrangement? Why should not a road receive as much for its cars as it pays for those it gets in the place of them? Why should a penalty be imposed on a road that runs cars fast and delays them little? Yet this is what happens under mixed per diem. Take the case of a car 100 miles from home. On one road it is run at the rate of 25 miles per day (four days), and being delivered the fifth day to its owners, it is 5 days in making the trip. For this the road pays \$1, or 20 cents per day. Another road runs the car 100 miles per day, delivering it home 3 days before the other, giving the owner a chance to make from \$2 to \$3 per day out of it, yet has to pay 35 cents per day. Oh, equitable mixed per diem! This is the system that these gentlemen, advocates of the mixed plan, wish to retain! This is the fair and equitable method of remunerating car owners which is contrasted with the inequitable (?) straight per diem!

But is it the long lines only that are benefited by straight per diem, as the committee infer? Of what use statistics are to gentlemen who hazard such an assertion, it is hard to see, since the merest glance at the figures they present serves to show the falsity of the inference. The very first road on the list, the Atchison, Topeka & Santa Fé, one of the longest, if not the longest road in the country, would lose \$6,000 per month by adopting straight per diem, rather than mixed. The Richmond & Danville, and the Philadelphia & Reading,

* The figures will be found in the proceedings of the Time Convention for October and in Sechrist's Equipment Guide for December, 1888. I have included the N. Y. & O. with the Erie, and the Pennsylvania Co. with the Pennsylvania Railroad.

both long roads, lose on straight per diem \$240 and \$1,430 per month, respectively; while the Fall Brook Coal Co. with only 250 miles of road would make \$7,850 per month by the change. The Beech Creek, 125 miles, would make \$600. The West Virginia Central, 89 miles, would make \$275. These examples will suffice. It is not length, but performance, which is the governing factor. Out of the 47 roads which report, 24, representing 19,000 miles and 257,000 cars, would gain by adopting straight per diem, and in every case their performance is better than that of the roads which borrow their cars. Sixteen roads, representing 12,000 miles and 103,000 cars, would lose; and in all cases, except two, foreign roads do better by them than they do by foreign cars; and in these two cases the simple explanation is, that the movement on their lines was not enough better to overcome the disparity in the number of cars they loaned, compared with what they borrowed. Seven roads would neither make nor lose appreciably.

What better evidence of the value of straight per diem, to promote prompt movement and prevent detention, do we want than these figures? With the disproof of the inequity of straight per diem, and with a re-assertion of its advantages over any modification of the mixed plan, the argument here properly closes. The writer believes that so far from the adoption of the mixed plan being a step in the direction of reform, it will, on the contrary, be better to bear the ills we have until they become insupportable, rather than put off the day of a true reform by adopting a system which will in the end be found to please nobody.

EDMUND YARDLEY.

The Water Brake.

A recent circular of a committee of the Master Mechanics' Association asks for information as to the actual use of the water brake. The accompanying illustration shows the application of the Le Chatelier brake, which is in use on the Northern Pacific, the Denver & Rio Grande, the Barre Railroad in Vermont and other roads in this country. While it is well known that M. Le Chatelier's device is not new (it was used in France and Switzerland at least 20 years ago) the recent use of it on the long and heavy grades of the mountain roads in the West has awakened a new interest in it.

The water brake is applied to locomotives for the purpose of furnishing an additional braking power when descending long grades where the driving tires would be liable to become dangerously heated if the driver brake shoes were continually applied with full braking effect.

Fig. 1 shows the side view of the locomotive with the device applied, also a section of the cylinder with the water pipe entering the exhaust passage. A is the exhaust passage; B is the steam passage; C is a $\frac{3}{4}$ in. pipe which enters the boiler below the water line. This pipe is attached to the valve shown at D, fig. 1, and E, fig. 2. The end of the pipe where it enters the exhaust, as shown at F, is enlarged to $\frac{1}{2}$ in.

Fig. 2 shows the rear view of the locomotive and the cylinders. The valve E is placed on a level with the lower gauge cock—G being the gauge cock—thence a pipe leads to an elbow at H, thence along the side of the boiler, as shown in fig. 1, to two elbows at I and J, from which lead $\frac{1}{2}$ in. pipes into the exhaust passages of each cylinder.

The operation of this brake may be described as follows: When descending long grades the valve motion is reversed when the engine is going ahead, which causes the cylinders to act as air pumps and exert a retarding influence on the engine by reason of the back pressure accumulating. A jet of hot water admitted, by the piping and valves shown in the cuts, into the exhaust passage lubricates the cylinders and pistons and furnishes vapor for compression, which prevents heating of the cylinders and drawing in hot air and cinders from the smoke box. During the compression of the air and vapor the water is evaporated; this evaporation absorbs the heat generated by compression.

The exact mode of procedure necessary to apply this brake in a proper manner is as follows: Open the cylinder cocks and reverse the valve motion, then open the water jet. This admits water to the cylinders. The required amount of water can be determined by watching the cylinder cocks; as soon as the water shows going through them the water valve is sufficiently open. It is only necessary to inject sufficient hot water for the heat due to compression to evaporate. The evaporation of the water absorbs heat by rendering it what is known as "latent," and prevents the cylinders from becoming overheated, which would be the case if air alone was used. The speed of the engine can be governed by the regulation of the reverse lever. The nearer the reverse lever is to the centre the less will be the retardation.

The simplicity of this device can be appreciated by an inspection of the illustration.

The following letter from Mr. N. W. Sample, Superintendent of Motive Power and Machinery of the Denver & Rio Grande, shows the success with which the brake has been used upon grades as long as 30 miles, and in some cases as heavy as 211 ft. to the mile:

"After six years of continual experimenting with all kinds of driver brakes on the long grades of this line, we finally, in 1883, discarded everything in the shape of a shoe on the wheel brake, and have since relied entirely on the water brake (Le Chatelier's), which I believe to be, in the fullest sense of the term, the best driver brake known to-day. That with it, the retarding force is applied equally to each connected pair of drivers, through the side rods, and with less damage to the tire than any system of shoes, and with no more strain or wear than is occasioned by the propelling force ascending, must be admitted by all. As to its efficiency, I can only say that we pass from 40 to 60 engines daily, over grades from 11 to 30 miles long (211 ft. to the mile), and have never known an instance in which the device failed to

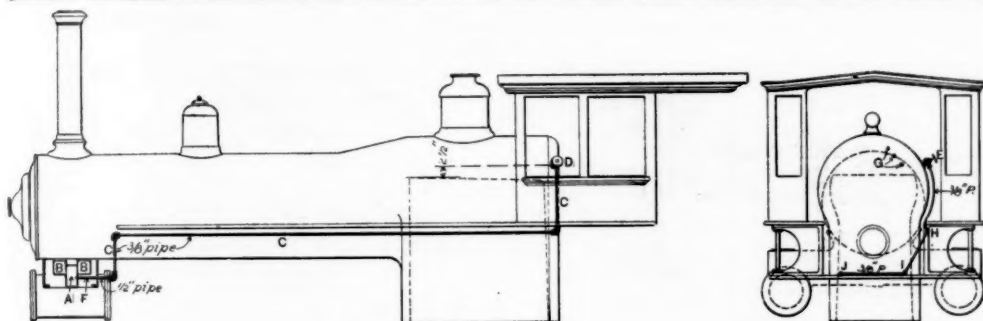


Fig. 1.
ARRANGEMENT OF THE LE CHATELIER WATER BRAKE.

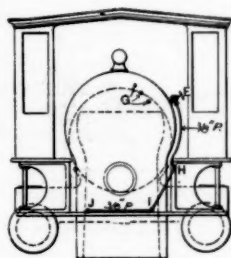


Fig. 2.

work satisfactorily, if properly handled, or that the engine did not arrive at the foot of the grade in good condition.

All of our engines are provided with it, no other brake being used on driving-wheels. Engine tenders and all cars are provided with Westinghouse brakes. The cylinders of the engines using the Le Chatelier brake continuously are better preserved than those on lighter grades, where the tender or train brakes alone serve to hold the engine. I attribute this to the pressure in the cylinder carrying the piston centrally. Where there is no pressure the piston drags on the bottom of the cylinder at the front end."

The Northern Pacific rules for employés in the use of air-brakes, which are printed in this issue, contain the instructions for the use of this appliance.

Northern Pacific Rules for the Use of the Westinghouse Air Brake.

The instructions issued by the Northern Pacific for the guidance of engineers and trainmen in the care and use of air brakes are compiled with unusual care. As that road has numerous grades of over 100 ft. per mile, and as its experience in the use of the pressure-retaining valve has been more extensive than that of most roads, these rules are of peculiar interest. This road, moreover, uses the Le Chatelier water brake, for which instructions are also given.

These rules are quite full, and we are unable to give the whole code for lack of space. We print below those which are of especial importance or novelty, omitting all those which are substantially similar to the rules on the same subject as found in the codes of the other large roads. Each branch of the subject is headed with a title in bold-faced type. These headings we have changed to italics, and we have also in numerous cases run two or three paragraphs into one for the sake of economizing space. In the text of the book a great many of the words and phrases requiring special emphasis are printed in italics. These are here shown in Roman letters. Although these rules are much more carefully written than most documents of the kind, there is still room for improvement. Some of the paragraphs, which perhaps seemed of minor importance to the compiler, show evidence of having been composed with less care than others. The tendency of the average rule-maker to embody two or three, or a half-a-dozen, important ideas in a single sentence, when they ought to be separated, is apparent even in this excellent code, and the absolute necessity of seeing that the men not only read the rules, but that they comprehend them, is impressed upon one more than ever after reading this manual. Instruction of a person who is entirely ignorant on a subject, or is supposed to be so, demands emphasis on every sentence, and often on almost every word; but in writing a rule the tendency of a person who knows all about the subject is to include as many subjects as possible in each sentence. These opposite views need to be reconciled more than they are.

This book is especially to be noted for its explanation of terms. For instance, rule 9 explains what is meant by "straight air." It is impossible to make explanations of this kind too plain. Rule 37 is a good example to be studied by those who believe in telling men only what they must do and omitting all warning of what should not be done. Rule 46 is a good example of delicately diplomatic language. While all officers like to see the speed of trains kept at a uniform rate in descending grades, and generally leave the engineer to work out for himself the problem of maintaining a uniform rate while using the automatic brake, this rule, without explicitly telling the engineer he may almost come to a stop for the sake of pumping up air, in effect gives him leave to do so when necessary. This is of course well, as he is told not to keep the speed "uniform," but to "control" it. Of course in doing this he may in extreme cases be compelled to very nearly come to a stop.

GENERAL INSTRUCTIONS TO ENGINEERS, TRAINMEN AND INSPECTORS.

Pressure Retaining Valves.—11. This valve is attached, under each car, by a small pipe leading to the release port side of the triple-valve. It can be used only when operating automatic air and only when descending mountain grades.

Operation of Pressure Retaining Valves.—12. In operating the pressure retaining valves the plug handle of same must be placed horizontally (—), and 10 lbs. pressure of air is retained on the brakes constantly, by means of the weighted valve contained in the valve case, which has to be lifted whenever any of the air pressure is exhausted. The small openings in the body of the pressure retaining valves serve as air exhaust passages, when used automatically, and must always be kept open.

To Cut Out the Pressure Retaining Valve.—13. Cut out the pressure retaining valve by turning its plug handle down (|), in which position it must always remain when not in operation.

15. The main pipe on the tender should be provided with a separate drain-cup with a cock, so that it can be drained daily in cold weather.

Train Men and Engineers.—18. After making up or add-

ing to a train, or after a change of engines, the rear brakeman shall ascertain whether the brake is connected throughout the train. The engineer must, under the circumstances, always test the brakes, to insure their being properly coupled and in order for use.

20. When there is occasion to apply the brakes from the cars the conductor's valve must be held open, to allow the air to escape, until the train is brought to a standstill, but this method of application should only be used in cases of emergency.

22. The discovery of a defect in the brake apparatus affecting its working, either before or during a trip, must at once be made known to all train men and the engineer, and a proper understanding had in regard to same to insure safety and personal convenience in handling the train. All train men are equally interested and responsible in such cases.

23. Under ordinary circumstances, before detaching the engine or any cars, the brakes must be fully released on the whole train. Neglecting this precaution, or setting the brakes by opening a valve or cock when the engine is detached, may cause serious inconvenience in switching. Hand-brakes must always be set on air-brake cars set out at intermediate stations.

Changing Engines.—24. In changing engines it may occur that the one taken on will not have as great air pressure as the engine taken off from the train and in such case it will be found, when coupled, that all the brakes in the train will be applied, and it may take too long to pump up the difference in pressure on engine necessary to overcome the extra pressure in reservoirs of cars. In such case, on passenger trains, open the release cock on the auxiliary reservoir until the air releases through the triple-valve in its natural manner. When this point is reached close the cock in auxiliary reservoir. The time this will take will vary from one to four seconds to each car, as difference in pressure may require. Do not open the release cock on brake cylinder, for this may require repeating several times before sufficient reduction in air pressure is reached. A good plan in these cases is to commence at head end of train and first ascertain if the engine is properly supplied with air, as in case it is not it may be necessary, and is quite important on a heavy grade, to leave the brakes set until there can be a good pressure obtained on engine reservoir. After this is assured release the pressure on cars as above stated. As this refers to a difficulty most frequently experienced, train men should understand about how to act.

Break in two of train.—25. In case a train breaks in two the brakeman should close the stop-cock on the rear car of the part of the train remaining attached to the engine, when he reaches it, and then give the engineer signal to let the brakes off. When cars are again properly coupled up before opening the air into the rear end of the train the brakeman should give the engineer signal to set brakes, which should be done strong, and be left on until brakeman opens the air-cocks into rear section of train. When this is done engineer will have regained control of the air in the entire train, as before the break in two. This action will save valuable time which otherwise may be spent in releasing the air on each car by hand.

Automatic Air Train Signals.—26. All passenger cars, and cars used in passenger trains are equipped with the air signal attached to the engine.

When it is desired to give a signal to the engineer the car signal valve, placed just over one of the car end doors, is opened by pulling the cord. This permits the air to escape, lessens pressure in main pipe and releases air from the signaling reservoir, which passes through the diaphragm to the whistle in engine cab. The breaking in two or separating of hose connections operates this whistle automatically in the same manner as the automatic air is operated on train brakes, and is as certain in its operation. Signals from cars may be given as rapidly as desired, up to four (4) per second.

In case there should be dirt lodged under the signaling valve the escape of air will cause the whistle on engine to sound continuously, and in this case the small cock placed on the connecting pipe over car door should be shut off. This cuts out the signal on the one car shut off only, and all others in train may be operated regardless of the defective signal valve. The closing of this cock will enable the signal valve to be removed for cleaning while the train is in motion and air pressure is on signal apparatus. Any defects discovered in the signaling apparatus should at once be reported for repairs.

Engineers.—* * Tallow and lard oils must not be used in the air cylinder. 29. The air cylinder must be oiled through the small cup provided for the purpose. The practice of having oils sucked from a dish into the lower end of an air pump serves to gum up the valves and air passages, and the relief which is in this manner at times sought, from heating of cylinder is only temporary at best. In case air pump does get hot in operation on road, use a small amount of valve oil, not tallow, to overcome the difficulty temporarily. Headlight oil will cut the gum out, but except it is very thoroughly cleaned out will cause heating worse than before, and is bad oil to use on this account. 30. The best means for cleaning out air pump thoroughly, and it should be done at shops, is to disconnect the discharge pipe and pump through a few quarts of weak lye, discharging it into a proper dish and pumping it through again until all passages are thoroughly cleaned. After the lye use clean warm water to thoroughly clean out all passages, then remove the lower head, shove the piston to the upper head and oil the cylinder bore with oily waste. This occasionally done at shops will insure good working air cylinders.

31. Run the pump constantly but never faster than to maintain the required air pressure. Have the governor set to maintain, on all passenger or freight trains, 80 lbs., 32. All engines must have the same air pressure, regulated by the governor, and if any variation is noted report must be made of it on repair register book. The pump governor must be used constantly. Pressure gauge must always show pressure on reservoir.

34. The brakes are fully applied when the pressure, as

shown on the gauge, is reduced 20 lbs. Any further reduction is a waste of air.

36. Engineers, upon finding that the brakes have been applied by the trainmen, or automatically, must at once aid in stopping the train by turning the handle of the brake valve toward the right, thus preventing the escape of air from the main reservoir.

37. Engineers of all trains must avoid making exhibition stops, and must never, except on a heavy grade, or in case of necessity, hold the brakes fully applied until the train comes to a full stop, as this causes a reaction in motion of train which is very disagreeable to passengers, and in case of a long freight or stock train is damaging where there is much slack in the couplings. This can be avoided, ordinarily, on passenger trains, by releasing brakes gradually before a full stop, so that all the air will be off at the moment stop is made. 38. No man is fully competent in use of air brakes who does not study and practice this point, and especially is he incompetent to handle passenger trains.

39. It is important to drain the water out of the main reservoir once a week, and in winter time daily. If the pump-rod is not kept well packed water will collect in main reservoir freely.

40. If cars having different air pressures are coupled together, the brakes will apply themselves on those having the highest pressure. To insure the certain release of all the brakes in the train, as also that trains may be charged quickly, the engineer must carry the maximum pressure in the main reservoir before connecting to a train, and then put the handle of his brake valve in the release position until the train is charged with air. If the brakes on the engine and tender thus apply themselves by being coupled to a train not charged, they should at once be taken off by opening the release cock from the auxiliary reservoir. See Rule 3. 41. Automatic brakes are applied when the pressure in the brake pipe is suddenly reduced and released when the pressure is restored.

42. It is of very great importance that every engineer should bear in mind that the air pressure may sometimes reduce slowly, owing to the steam pressure getting low, or from the stopping of the pump, or from a leakage in some of the pipes when one or more cars are detached for switching purposes, and that in consequence it has been found absolutely necessary to provide each cylinder with what is called a leakage groove, which permits a slight pressure to escape without moving the piston, thus preventing the application of the brakes when the pressure is slowly reduced, as would result from any of the above causes.

43. This provision against the accidental application of the brakes must be taken into consideration, or else it will sometimes happen that all the brakes will not be applied when such is the intention, simply because the air has been so slowly discharged from the brake pipe that it only represents a considerable leakage, and thus allows the air under some of the cars to be wasted. 44. It is thus very essential to discharge enough air in the first instance, and with sufficient rapidity to cause all the leakage grooves to be closed, which will remain closed until the brakes have been released. See Rule 33. In no case should the reduction in the brake pipe for closing the leakage grooves be less than 4 or 5 lbs., which will move all pistons out so that the brake shoes will be only slightly bearing against the wheels. After this first reduction pressure can be reduced to suit the circumstances. See Rule 34.

45. On a long train, if the engineer's brake-valve be opened suddenly and then quickly closed, the pressure in the brake-pipe, as indicated by the gauge, will be suddenly and considerably reduced on the engine, and will then be increased by the air pressure coming from the rear of the train, hence it is important to always close the engineer's brake-valve slowly and in such a manner that the pressure, as indicated by the gauge, will not be increased, or else the brakes on the engine and tender, and sometimes on the first one or two cars, will come off when they should remain on.

46. On long down grades it is important to be able to control the speed of the train, and at the same time to maintain good working pressure. This is easily accomplished by running the pump at a good speed, so that the main reservoir will accumulate a high pressure while the brakes are on. When, after using the brakes some time, the pressure has been reduced to sixty pounds, the train pipes and reservoirs should be recharged as much as possible before the speed has increased to the maximum allowed. A greater time for recharging is obtained by considerably reducing the speed of the train just before recharging, and by taking advantage of the variation of the grades.

47. To release the brakes with certainty it is important to have a higher pressure in the main reservoir than in the main pipe. If the engineer feels that some of the brakes are not off it is best to turn the handle of the engineer's brake-valve just far enough to shut off the main reservoir, and then pump up fifteen or twenty pounds extra, which will insure the release of all the brakes, all of which can be done while the train is in motion.

Mountain Grades.—49. Before starting up or down grades which exceed one hundred feet per mile and one-half mile in length, examine brakes and air apparatus carefully. 50. Going down grade, examine the shifting links, nuts, bolts and connections of same, to insure their being in order for reversing engine, and the use of water-brake.

Engines Coupled on Mountain Grades.—52. When two air-brake engines are coupled to a train the forward engine must control the air-brake, but both engines should be coupled up to the air-pipes, and may be used to pump air into the train auxiliary reservoirs, in case it is desired to do so, when train is not in motion. When train is in motion the rear engineer must "blank the air" by turning the valve to the right, nearly to the point of application, and let the leading engineer do all the braking.

Otherwise the brakes may all be pumped off, by the rear engineer, very soon after the brakes are applied by the first engineer, and this will render the brakes useless. Hence the leading engine must control the train brakes entirely and absolutely, except in case of accident to air of leading engine, and until a proper signal is given by the first engineer for the second engineer to assume control of the air-brakes on train, for which contingency the second engineer must at every moment be prepared to act instantly on a mountain grade. **Whistle Signal.**—Two short full blasts with one long blast (—) is signal that for some cause the air on leading engine has failed, and it is desired to give up control to the second engineer, who by repeating the signal, signifies that he understands and has control of the air-brakes. Having assumed control of the brakes the second engineer will retain entire charge of same to the end of the trip, except in case of necessity which may reverse the operation.

There must not be any experiment or practice with the air-brake when attached to trains on mountain grades; this must be gone through with at other times. 53. Have always in mind on mountain grades to keep control of train. Descending at high speed must not be practiced with any train, for there may come a time when some part of the machinery may fail, and while practicable to control speed by hand-brakes at eight to ten miles per hour, it may be impossible at twenty to thirty miles per hour to regain its control.

Driver-Brakes.—* * * 55. Driver-brakes must be used daily, at points to be named by the Master Mechanic, on all

engines fitted with them, and sufficient to insure their being in good working order. 57. It is not designed to use driver-brakes in stops of trains, except in cases of necessity, as their use causes a shock on the cars disagreeable to occupants of passenger trains. 58. When driver-brakes are, from necessity, used on engines attached to passenger or other trains, they should be released gradually and before a full final stop is made. 59. Engines must not be reversed with driver-brakes set. 60. A too free use of the driver-brake on mountain grades heats the tires of driving wheels, expands and loosens them on wheel centres, and this not only destroys their brake efficiency, but will make engine useless for draft purposes also.

61. It must be remembered that water-brake acts on the drivers and that the combined use of water-brake and driver-brake will be too great, causing the sliding of wheels, hence the combined use of water and driver brake must not be made.

Water-Brakes.—62. The "Le Chatelier" (water) brake is, on this road, intended to be used as auxiliary to other brakes, and when used with discretion is a valuable aid in steadying an engine down mountain grades. It is most effective on a steady motion, of from three to twelve miles per hour, above which latter speed it is of less value. It should not be used at a greater speed than eighteen miles per hour, and is for mountain work only. **Operation of Water-Brake.**—63. Water is led by a small pipe connected to the boiler, below water line of same, to the exhaust-pipe cavity and through to the cylinders. This affords a counter pressure on pistons when engine is reversed, which should be just back of the centre notch of quadrant. The act of forcing compressed moist vapor—which the water jet drawn into the cylinders, with engine reversed, supplies—back into the boiler causes the retarding force on pistons, operating through the connections, on crank-pins and gives the desired brake power. Only a very small amount of water is used, a portion of which, except that put into vapor and returned to boiler, passes through the open cylinder cocks. The amount of force or brake power exerted depends upon the position of the reverse lever.

The following rules in the use of the water-brake must be observed: 64. First have engine in slow motion without steam, have cylinder-cocks wide open and keep them open, with reverse lever placed one notch back of the centre and throttle securely shut. Give the small water-cock a full turn open and notice that steam-water passes the cylinder-cocks freely. The speed may now be regulated by placing the lever back as required and should be done without any change in the water-cock. A too free use of water is dangerous to cylinder heads, and water may be forced out of the smoke stack and does not produce any useful effect.

In shutting off the water brake throw the reverse lever ahead slowly, first closing the water-cock, to avoid throwing water from the stack. Light engines, when fitted with air, or steam brakes, and water brakes are best controlled by setting the water brake moderately and using the air or steam tender brake to regulate speed. In cases of necessity the water brake, the train brake and all other available means may be used together. Always be careful, however, in setting water brakes.

Forty-ton Side-Dumping Gondola Car.

The three truck side-dumping gondola car shown in the illustration is one of the largest cars ever constructed, and was built for the Pennsylvania lines west of Pittsburgh, at the Ft. Wayne shops, by Mr. F. D. Casanave, Superintendent Motive Power. These cars are 80,000 lbs. capacity, when loaded with ores, which is the greatest capacity of any cars of this type running in this country. This car is fitted with centre trucks, the details of the attachment of which are shown in the illustration. Although intended to carry heavy loads, these are not large cars, being only 29 ft. 2 in. long in the body. The method of holding up the sides of the car by means of cross trusses is shown in detail at A and B, fig. 4; the method of opening and shutting the side doors is shown in fig. 5, and the very strong and well arranged draft rigging is shown at C, fig. 1. This draft rigging is worthy of notice by those who are now having trouble with the designs on common cars.

Fig. 1 shows a half side elevation and half sectional elevation. Fig. 2 shows one-quarter of the plan with the floor removed and a portion of the plan with the floor in position. Fig. 3 shows one-half of one end view and one-half of section through the centre of the car. Fig. 4 shows the detail of the car trusses, which have many new features. Fig. 5 shows the method of opening and closing the doors, which, in all cars of this type, is a very important problem, particularly in winter weather, when the ore is liable to be frozen in a solid mass. Fig. 6 shows details of a locking gear as it appears from the end of the car. Fig. 7 shows the same in plan and part section as it appears from the top of the car.

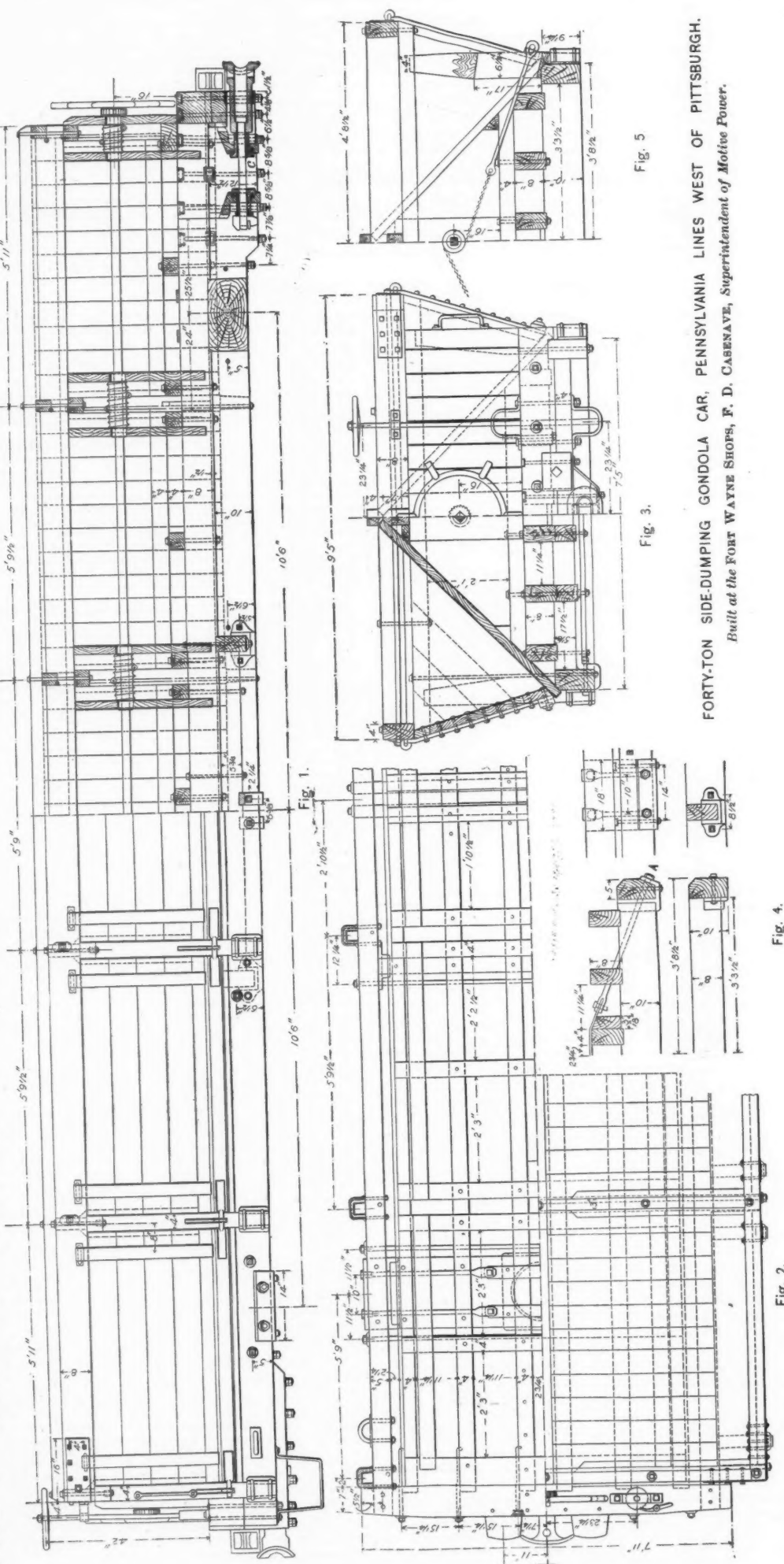
These cars have three trucks each, being fitted with Finlay's centre and side bearings on the centre truck. The details of these side bearings are shown in fig. 8.

The rollers on which this car is carried at the centre are shown at D and E, fig. 8. The rollers D are made of cast-iron with chilled surfaces. The small rollers shown at F are made of wrought iron, case hardened. The guiding rollers G are made of cast iron with chilled surfaces. The trucks used in this car are the Pennsylvania "new standard," with 4 x 8 in. journals. The whole interior of this car is lined with iron.

Test of the "Return System" for Train Heating on the Pennsylvania.

On Wednesday of this week a special train of 12 cars, fitted with the return system, in use on the Pennsylvania road, left Philadelphia at 1 o'clock on an experimental run to Jersey City, the purpose being to exhibit the action of the apparatus, the method of operation and details of construction to a large number of railroad officers present by invitation. The train consisted of 12 day coaches, each fitted with the apparatus. In two of the cars the seats were removed to exhibit the piping, and in one of these cars all the pipe covering and shields had been taken away; this enabled the spectators to comprehend at a glance the arrangement of the heating pipes.

The following is a general description of this system. Steam is taken from the combination stand on the boiler-head, through either a regulating or reducing valve, and conducted through a hose between the engine and tender to a



"tee," one opening of which is connected with a reducing valve on the train pipe, the other being connected to the admission port of a small "Knowles" vacuum pump placed on the left-hand side of the tank on top of the leg at front, and covered with a wooden covering. The object of the vacuum pump is to reduce the pressure in, and extract the condensation from, the return pipe of the steam heating system. This condensation can be returned either to the tank or to the open air, as may be desired. The two main lines of piping,

i. e., the outgoing and return pipe, are almost perfectly straight from end to end of the train, the variation in alignment being only 1½ in. at a maximum. The coupling used is a positive, "straightaway" coupling with an expansion joint, the packing in which is vulcabeston. The gasket used is also of vulcabeston. This coupling is secured by a rotation of the handle around the train pipe, which causes a cam to press the joints firmly together. There is no connection between the outgoing and return pipe except through

Forty-ton Side-Dumping Gondola Car, Pennsylvania Lines West of Pittsburgh. Built at the Fort Wayne Shops, F. D. Casanave, Superintendent of Motive Power.

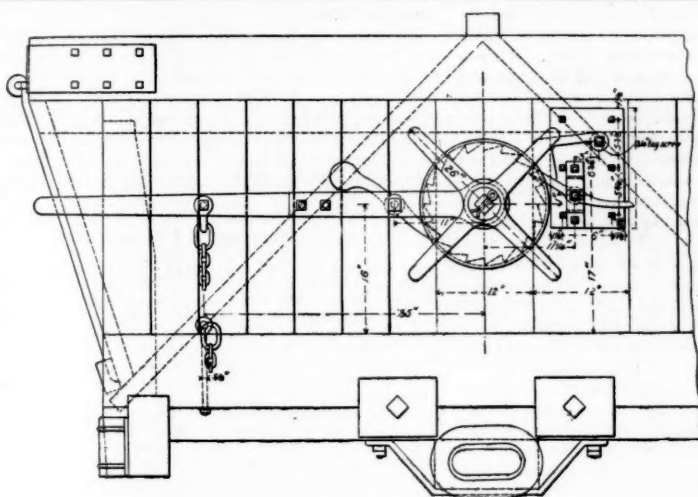


Fig. 6.—Lock Gear.

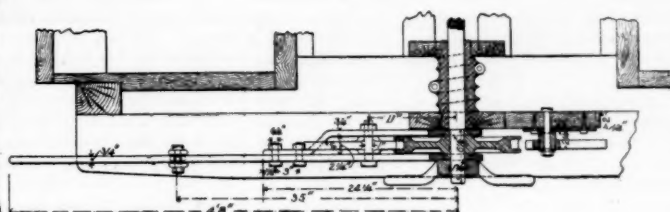


Fig. 7.

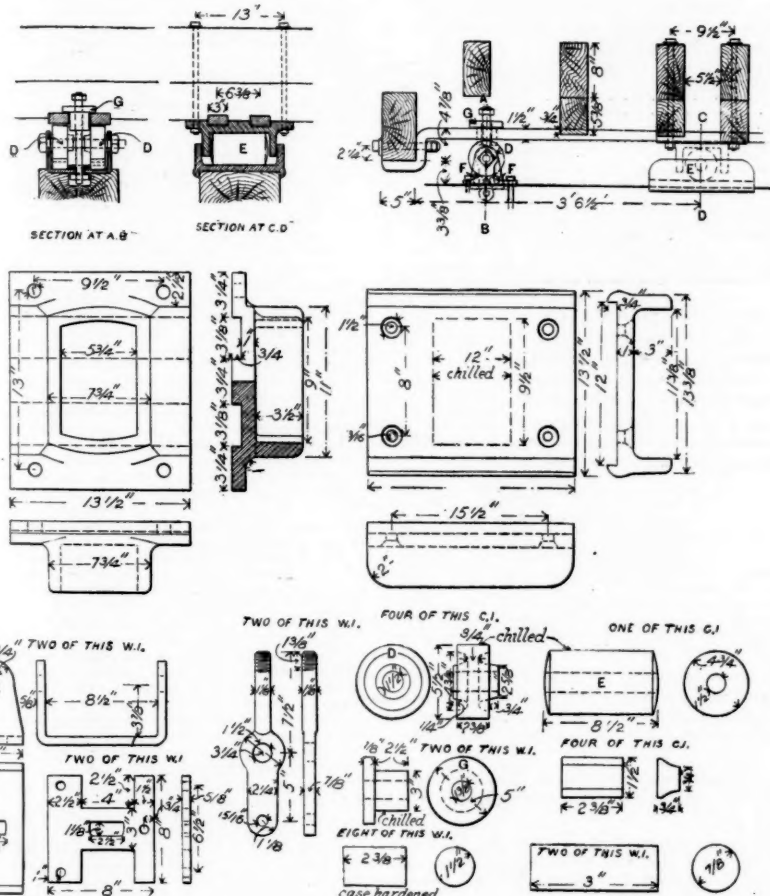


Fig. 8.—Details of Finlay's Centre and Side Bearings applied to Centre Truck.

FORTY-TON SIDE-DUMPING GONDOLA CAR.—PENNSYLVANIA CO.

the heating pipe in the car. This connection through the car may in general be described as follows:

Steam is taken from the train pipe at a 3-way cock, placed underneath the car, with a stem extending up to and above the floor of the car, where it can be readily operated by a wrench. From this 3-way cock the steam is conducted to a steam-reversing valve, which is used for the purpose of reversing the direction of the entering of the steam when the locomotive is changed from one end of the train to the other. From this steam reversing valve the steam is conducted to a controlling or admission valve, by which the heat in the car is regulated. From this valve the steam passes through $\frac{3}{4}$ in. pipe to both ends of the car at the four corners, where it enters coils of iron pipe. These coils are surrounded by a wooden boxing, in the top of which are placed brass registers which can be opened at will. Air for the ventilation is admitted by five $2\frac{1}{4}$ in. holes in the bottom of the car, underneath the boxing. This air, after being heated by passing over the coil of pipe, is admitted through the registers into the car itself. Further ventilation is obtained by $2\frac{1}{4}$ in. holes located along the bottom of the car underneath the side piping and directly under the seat, one of such holes being located at each seat. These holes are lined with cast-iron thimbles. The steam, after passing through the heating coils at the end of the car, then enters the long cast-iron radiators at the sides of the car, which have thin cast-iron fins to increase their radiating surface. Under each seat, projecting out from the face of the cast-iron radiating pipe, is placed a spur of 2-in. wrought-iron pipe with a blank end, which is screwed into and inclined toward the cast-iron radiator.

The condensation from this system flows towards the centre

of the car, where an opening is provided through a waste valve by filling a notch in the seat of the valve. This waste valve can be opened if necessary. Through this small groove in the seat of the waste valve all condensation must pass to reach the return pipe. Condensation passing through this waste valve will become re-evaporated into vapor at a pressure below that of the atmosphere, owing to the vacuum maintained in the return pipe by means of the vacuum pump. Sometimes, indeed, a vacuum will extend beyond this waste valve, and it will be found to exist even just outside of the reducing valve on the outgoing steam pipe. In such cases the cars are being heated by steam at a pressure below that of the atmosphere; steam at such pressures still contains a large amount of heat, quite sufficient to render the cars comfortable in mild weather.

The return pipe, after passing the whole length of the train, finally connects with a condensing coil at the bottom of the tank on the tender. At this point all of the vapor is condensed into water, which is pumped by the vacuum pump either into the body of the tank or into the atmosphere, as may be desired. This system can be used as a direct steam system, without a trap, in case any accident should befall the vacuum pump or the return connection, simply by rotating the stem of the reversing steam valve so as to close the return connection and open the pipe leading from the waste valve to the atmosphere. This movement is accomplished by turning the index attached to the stem of the reversing valve, and extending to the top of the floor of the car from the point marked "Return" to that marked "Direct."

One of the most difficult ends to accomplish in the steam heating of railroad cars is the proper regulation of heat

and ventilation in mild weather. For this reason the mild weather of Wednesday last furnished conditions which were very trying to any steam heating system. Under these conditions this system, during a three hour run, maintained the temperature of the cars at about 70 degrees, while the ventilation, as a result of the system of air inducts was all that could be desired.

Tide-water Terminals of the Southern States.

BY L. M. HAUPT, C. E.

The rapid concentration of the railroad lines in the South has resulted in the establishment of numerous well defined systems, embracing thousands of miles, under the same management. A glance at the "folders" of these trunk lines is indicative of the general direction of the movement of traffic and the extent of the areas drained by the feeders.

Thus, the Louisville, New Orleans & Texas system, extending from Memphis 455 miles along the eastern bank of the great river, drains a territory containing about 25,000 miles of feeders into New Orleans.

A short distance to the east, and extending through the rich cotton belt of Mississippi, stretches the Illinois Central, connecting Chicago with New Orleans, 915 miles, and tapping numerous laterals.

Radiating from this same terminus is the "Queen and Crescent" system, reaching to Cincinnati, 826 miles north-east, and to Shreveport, 509 miles northwest.

From this same centre, the Louisville & Nashville system is seen extending eastwardly along the gulf coast to the Chattahoochee, Florida, touching at the ports of Pascagoula, Mobile and Pensacola, and having another trunk reaching northward to Cincinnati, 921, and St. Louis, 944 miles, with numerous branches in Western Kentucky and Tennessee. It embraces over 3,250 miles. The nearest port for this system is at Pensacola. To reach New Orleans, requires a westerly haul of 246 miles, and thence the distance by river to the Gulf is about 100 miles. From Chattanooga on this system the Atlantic ports of Brunswick, Savannah and Port Royal, of the Richmond & West Point Terminal system, are all nearer than Pensacola and avoid the passage through the Straits of Florida, about 1,200 miles.

New Orleans is also the eastern terminus of the Southern Pacific System extending 2,495 miles to San Francisco, and throwing out feeders into Mexico and adjacent territory. Thus it is seen that the various systems of railroads converging at this focal point include many thousand miles of lines. To this may be added the traffic by the rivers reaching from the Alleghenies on the east to the Rocky Mountains on the west and almost to the Great Lakes on the north. In view of this condition, it is not remarkable that in the six years from 1881 to 1887 her exports fell off from \$104,028,471 to \$79,539,731, or about 23 per cent! This result cannot be ascribed to lack of sufficient depth of water, for since the opening of the South Pass, in 1879, the harbor of New Orleans has been accessible to vessels of the deepest draught.

Two systems extend from the Chattahoochee eastward to the Atlantic, at Jacksonville, Fernandina, and Brunswick. They include the lines of the Florida Railway & Navigation Company and the Plant System. The second, covering 1,029 miles, is located in a comparatively undeveloped portion of the South, where the principal business is in lumber. It is evident that these trans-pennsular lines obtain none of the coast or foreign traffic which may be shipped from points north or west. They cannot compete with the Straits of Florida because of the cost of trans-shipments.

The most comprehensive of these consolidated companies is the Richmond & West Point Terminal, extending from the Mississippi at Greenville and Memphis, and from Chattanooga, Knoxville and Bristol in the mountains, down the eastern escarpment to Brunswick, Savannah, Port Royal, Richmond, Norfolk and West Point on the Atlantic. The advantages possessed by this system are more clearly shown by a comparison of distances by the several routes to the same point at tide-water. Thus from Greenville, Miss., to Savannah, Ga., by rail is about 760 miles, while by the Mississippi River to the head of the pass in the Gulf, it is 581 miles, and thence to Savannah, via Key West, about 1,200 miles, making a total of nearly 1,800 miles. From Memphis the differ-

ence would be even greater, and it is found to increase as the land terminus is shifted north and east.

The Gulf ports east of the Mississippi labor under great disadvantages due to their geographical position, since from most interior points, by an equal or shorter haul, freight may be delivered on the Atlantic, and about 1,000 miles of navigation be avoided.

With reference to the trans-Mississippi region, however, the entire aspect of affairs is changed, as the nearest deep water will be that point of the Gulf coast which is farthest north and west, and which will be found to tap a tributary area larger than may be found at any other point on the globe. Our purpose now, however, is to consider the relative facilities afforded by these eastern Gulf and Atlantic ports, as terminals where vessels of large tonnage may enter and clear without danger of fouling, and with fair prospects of securing a cargo.

Pensacola, Florida.—Until the improvement of the South Pass of the Mississippi, Pensacola had the greatest depth of water of any American gulf port, namely 20 ft. at mean low water, yet her geographical position was such as to limit her commerce to a relatively small amount. The act of Congress of June 18, 1878, contemplated the temporary relief of navigation by dredging a channel across the inner bar 300 ft. wide and 24 ft. deep, and estimated to cost \$275,000.

"Strong tidal currents cross the line of the dredged channel almost at right angles, and continuous dredging will probably be required. * * * Since 1878 there have been appropriated \$215,000, or an average of \$21,500 yearly. The works are tentative and require completion for protection. * * * Probably 50 per cent. of the original work has perished because of the failure of adequate appropriations for their completion. * * * At the date of the original project, the proposed channel required the removal of 36,000 cu. yds. of sand. On June 30, 1886, 142,000 cu. yds. had been removed, and about 40,000 remained to be excavated. Since that time no dredging has been done, and it is estimated, approximately, that 125,000 cu. yds. must be excavated to give the channel required. A depth of 24 ft. at mean low water, with a width of 120 ft., was at first obtained, but progressive shoaling has ensued. On June 30, 1888, a least depth of 22 ft. was reported, a gain of 2.6 ft. over the depth existing when the work was commenced."

The depth of water over the outer bar is 22.9 ft.; aggregate tonnage of vessels entered for year ending June 30, 1888, 351,905; aggregate tonnage of vessels cleared, 362,449, total, 714,354. Cotton imported, 3,446 bales. The bulk of this tonnage is lumber and timber. Total value of exports, \$3,200,648.

Mobile, Alabama.—The improvement of this harbor was begun as early as 1827, when the depth of water through Choctaw Pass was 5½ ft., and but 8 ft. on Dog River Bar. Up to 1857, \$228,830.68 had been expended, with the result of a channel 10 ft. deep and 200 ft. wide. In 1860 the channel through the pass was found to have shoaled to 7½ ft., the depth on the bar remaining the same. Nothing was done until 1870, when a project to give 13 ft. was approved, and up to September, 1876, \$401,000 were appropriated, and the work completed for a channel, 300 ft. wide, through both the pass and the bar. In March, 1880, it was decided to continue the improvement by dredging to a depth of 17 ft. and width of 200 ft., at an estimated cost of \$820,000. Under this project there have been appropriated \$750,000.

"The condition of the channel previous to the commencement of the present project was such that no vessel of greater draught than 12 ft. could come to the city, but all such anchored in the lower bay, a distance of 28½ miles, and the cargoes were lightered or rafted to and from the city at a great expense, and frequently at considerable loss of cargo and time. * * * The channel of 17 ft. depth, with a width of 75 ft., was opened in 1882, and during the business season of 1882-83 all vessels entering the bay came up to the wharves of the port and then discharged cargoes and ballast, then reloaded with full cargoes or to a depth of 16½ ft., and in some cases to 17 or 17½ ft., but owing to the vessels getting out on the slopes * * * it was deemed best to limit the draught to 16 ft. until the channel was widened. * * * The width being increased during the fiscal year ending June 30, 1887, the draught of all vessels loaded at the wharves was between 15½ and 17 ft., the average being 16, and in all cases passing through the channel without delay. * * * Since the commencement of the work, or from 1881 to 1888 there has been a shoaling above the projected depth of 17 ft. of about 1,600,000 cu. yds., or at the rate of about 228,600 cu. yds. per year. To remove this will cost about \$192,000; to complete the project, including preservation of improvement to June 30, 1889, \$276,000; for preservation of improvement, annually, \$30,000.

Commerce.—Entrances to June 30, 1888 (one year), 110,424 tons; clearances to June 30, 1888 (one year), 113,918 tons; total, 224,342 tons.

"Cotton exports¹, 62,488 bales. Total value of exports, \$3,568,766.03."

Comparison.—From these extracts it appears that whilst the value of the exports is about the same, the volume is greatly in favor of the cheaper and more bulky products of the forests surrounding Pensacola. Without this her commerce would be small, notwithstanding the fact that by nature she is endowed with three feet more water than has been secured at her neighboring port by an expenditure of about a million dollars.

The attempts to aid navigation by dredging at both places demonstrate the instability and expense of this method. The estimated cost of maintenance of a 17-ft. channel represents the interest on a half million dollars. There can scarcely be a question as to its being more economical and more satisfactory to add something to this amount, and construct a pier to a much greater depth than that now available. In fact it is stated that a corporation has already been chartered for this purpose. These ports are but 106 miles apart by rail or about 50 miles by the air line so that at a few thousand dollars per mile a road could be built to reach the 22 ft. of water at Pensacola, which, considering the question merely from an economic standpoint, would be a good solu-

tion, since it would furnish an excellent water terminal for the Mobile & Ohio, the Richmond & West Point and the Louisville & Nashville system, in at least 22 ft. of water, and possibly more, at far less cost than at Mobile. When it is remembered that the commercial value of a channel increases with the cube of its depth it would be seen how important this consideration becomes.

New Orleans is 141 miles west from Mobile by rail, and about 104 miles from the mouth of the Mississippi. It has a greater tributary river mileage than any city of North America, yet the path is so sinuous that it is 80 per cent. farther from Cairo by water than by rail, and the condition of the navigable channel is so unstable that the commerce of this port is not very greatly augmented in consequence. Moreover, the stream flows from cooler to warmer latitudes and thus debars the transportation of freights which are sensitive to thermal changes, and the existence of the Northern waterway furnishes an outlet for the agricultural products of the grain belt. For these and other reasons it is found that the transportation area tributary to the Mississippi River is in reality the smallest of the great areas of the United States and embraces but 300,000 square miles, that of the Lakes being 500,000, the Atlantic 550,000, the Gulf Coast of Texas, 1,000,000, and the Pacific 700,000 square miles. Notwithstanding its apparent advantages and the large railroad mileage terminating here, its commerce has not increased as rapidly as was anticipated and predicted before the opening of the pass.

The average annual exports, both domestic and foreign, are as follows in millions of dollars:

	New Orleans.	New York.
1863-5.....	5	235
1866-70.....	85	231
1871-75.....	91	325
1876-80.....	79	336
1881-85.....	86	388
1886.....	83	368
1887.....	80	335

"The foreign exports of the United States range from 20 to 30 millions, and of these about 60 per cent. are shipped from New York. The total foreign shipments are not, however, equal to one half of one per cent. of the domestic exports, about one-half of which goes out from New York. Next to it comes New Orleans, which has an export trade about double that of Philadelphia.

During the first three years the port was under blockade. The South Pass improvement was commenced in 1875, and by 1879 there was a 30-ft. channel through the pass, yet there is no apparent increase of commerce due to that cause.

Substantially the same conclusions are to be reached by a comparison of the cotton movements at this port. Thus the percentage of the entire crop received at New Orleans for the seasons from 1877 to 1887, was as follows:

	New Orleans.	Galveston
	Per cent.	Per cent.
1878.....	28.92	9.60
1879.....	23.40	11.47
1880.....	26.13	8.60
1881.....	10.33	10.33
1882.....	21.91	8.45
1883.....	24.17	12.69
1884.....	26.76	10.63
1885.....	27.00	8.52
1886.....	26.94	11.20
1887.....	27.08	11.57

The average being 25.67 per cent., yet the crop has increased from 3,832,991 bales in 1875 to 6,513,623 bales in 1887, being an increase of 70 per cent. In this same time the rail movement of cotton overland has increased 180 per cent.

In the "Review of the Cotton Crop of the United States," the Report of the Chamber of Commerce for New York, 1887-88, says:—

"New Orleans in its growth shows both what its new railroads are doing for it, and also what its improved harbor has effected. We cannot help saying here that this latter fact suggests a work to be done for all the other Southern outposts in improving their shipping facilities. Wasting money on creeks and leaving the great harbors through which our main crop is harvested to fill up is very poor economy. The people often forget that every saving on the actual cost of marketing our products is not only a local but a national gain. New Orleans has this year marketed 27.08 per cent. of the total yield of the country against 26.94 per cent. last year, whereas Galveston, in a state that raises over one-fifth of the entire crop, has only marketed 11.57 per cent. this year, against 11.20 in 1885-86."

The percentage moved at Galveston for the past decade averages 10.36 with very narrow fluctuations, and during this entire period the government have been vainly striving to deepen the water over the bar by a method which can only result in failure and which has already produced such injurious effects that protection works are now being executed. The shipments by water have, therefore, not kept pace with the increased production, whilst those by rail have increased 2.6 fold. Galveston is 411 miles by rail west of New Orleans, and over 2,000 miles from New York. By water it is about 2,900 miles. The average freight rate per ton per mile on trunk lines to the Atlantic is about 8 mills, while on the Texas roads it is said to be about 3 cents. The water rates may be taken at one mill. At these rates the difference in the cost of marketing products from Galveston, at New York, would be \$16 — \$2.20 = \$13.80. This would represent the saving per ton if shipped by water. Taking the cotton crop of Texas at one fifth the total, or, say 1,300,000 bales, equal to 315,900 tons, the saving on the cotton crops of Texas alone, if all were sent to New York by water, would be \$4,359,420. A large part of this is now expended in repairing the wear and tear of the railroads.

The low percentage of shipments from Galveston is unquestionably due to the risks and high rates for lightering over the bar. Were this obstruction removed, as we believe it may be, by a proper system of improvement, the commerce of this port would soon surpass that of New Orleans and re-

ciprocally would also swell the volume of every other port connected therewith.

The overland movement of cotton for the year ending Aug. 31, 1887, was the largest on record. Out of a total crop of 6,513,623 bales, 97,207 reached New York by rail. The total exports from New York were 847,853 bales, so that the amount brought by water was about 750,000 bales. This quantity would increase rapidly with the improvement of the Southern harbors and especially those of Texas.

In a subsequent issue the South Atlantic ports will be considered.

Steam Heating in the Northwest.

At the last regular meeting of the Northwest Railroad Club, held March 4, the subject of heating passenger trains was discussed. The problem of heating is in that region one of peculiar difficulty, as appeared from the experiences related in the discussion. As, for instance, Mr. Barber, Master Car-Builder Northern Pacific, stated that last winter they fitted up three solid trains with steam heating apparatus, and took special pains with every part of them. But when they were sent out in weather 20 deg. below zero, or thereabouts, it was not considered safe to let the trains go out without extra coal in the coal boxes in the coaches and the baggage cars. On one occasion, having been warned that a heavy snowstorm was coming, a train was sent with the expert of the steam heating company on board, and special brakemen selected from among the locomotive engineers who were available. The thermometer went down as low as —45.

Out in Dakota between Jamestown and Bismarck the train struck snow and the locomotive engineer said that he had to have all the steam or else lie there. It was decided therefore to abandon the steam heating and start up the stoves, and orders were given to disconnect and bleed the pipes. There were six cars in the train. Three of them were successfully disconnected and the pipes emptied, but the others froze up solid before the pipes could be emptied or stoves started. The expert froze both his ears and two or three fingers in less than 10 minutes, and if the train had not been provided with stoves the passengers would have frozen to death. Naturally in such climate the difficulties are somewhat greater than on the Atlantic coast.

At the meeting in question, Mr. W. T. Reed, Superintendent Motive Power Chicago, St. Paul & Kansas City, was in the chair.

A paper was read by Mr. W. H. Lewis (C. B. & N.), who pointed out the improbability of railroad companies failing to provide their trains with steam heating if any practicable device were to be had. He did not think that it was a question of cost or of obnoxiousity, but there is a warrantable doubt on the part of railroad officers as to the efficiency of existing systems, and inasmuch as the past winter has been unprecedentedly mild, the knowledge gained has not been so great as was expected. He had recently talked with a railroad man who had traveled from Chicago to New York over lines equipped with one of the best known systems, and his experience of the journey was a prolonged and exaggerated case of chills and fever. Mr. Lewis is inclined to believe that under present circumstances the danger of death to the passengers from pneumonia is greater than from burning of cars. He asserted that there is not in existence now one single system of heating by steam from the locomotive that is reliable under all conditions, and yet by an act of the Minnesota legislature all the Minnesota roads are required to remove the common stoves before Oct. 1, 1889.

Mr. Lewis' paper was followed by some remarks from Mr. W. S. Johnson. In Mr. Johnson's opinion the question of piping is a simple one, but a primary condition is that the cars should be well built with a view to their warmth. He said that you could hardly live in a house built in the manner in which cars are constructed. He thinks 200 sq. ft. of heating surface with 5 lbs. pressure will heat an ordinary car in ordinary weather. A difficult question in the opinion of Mr. Johnson is that of the trap. A coupling that will not leak can be made, but the question of trap is difficult. The trouble with most traps is that they do not open wide enough and begin to freeze before the water can discharge. In his opinion the question of steam heating of trains will be very quickly solved when a proper trap is introduced.

Mr. J. R. DROZESKI, of the Erie Car Heating Co., read a paper describing the apparatus of that company. A train of 4 cars equipped with the Erie heating apparatus has been running on the Fort Wayne Division of the Pennsylvania System since March, 1887, and left entirely in charge of trainmen. It has not failed for a single day to keep the cars warm, and has not cost more than \$10 for repairs. Other trains equipped with this system are running on the New York, Chicago & St. Louis, the Lake Shore, the Duluth & Superior Short Line of the Northern Pacific, and the Manitoba "short line."

Mr. E. A. WESTCOTT (M. C. B. C. M. & St. P.) : We have had on the Milwaukee for the past two winters a steam heating system running between St. Paul and Chicago. The first season the train pipes ran under the cars. The cars could not be kept warm. This last winter they have been carried through the cars overhead, but the weather has not been such as to give them a thorough test. So far, however, as the system has been severely tried it has been more successful than that used in the former season. The traps, however, are a failure. If the cars when set out do not stand level enough, water of condensation left in the pipes gives trouble from freezing. This is especially true where there are radiators at each end of the car.

Mr. J. O. PATTEE (Supt. Motive Power, St. P., M. & M.) stated that the trial of the Erie system on his road has not been sufficient for a thorough test. He inquired how much water is condensed per car per hour. He is inclined to think it is more expensive to heat by steam than by independent heaters.

Mr. WESTCOTT stated that from his tests the average consumption of water is about 6 gallons per hour per car in zero weather.

Mr. JOHNSON asked if the Baker heater in a common day coach is able to warm the cars in Minnesota in very cold weather.

The PRESIDENT replied that it was found so with sufficient pipe, say not less than from 400 to 500 ft. He has cars running with 440 ft. of pipe and gets a free circulation. It takes two or three hours to heat up with the Baker heater.

Mr. BARBER finds that the Baker heater with less than 300 ft. of pipe does not work well; 400 ft. will give better satisfaction.

Mr. PATTEE brought up the question of the disposal of the water of condensation. As it drips on the platforms it is a nuisance and a source of danger to the passengers. He has seen a place 6 or 8 ft. in diameter a solid mass of ice from this source.

An electrical trap was mentioned by one speaker as having been running for a year on one car of the Chicago, Milwaukee & St. Paul. This trap opens for ten seconds and then is closed for half an hour. It is suggested that it might open in a station and thus add to the present inconvenience.

Mr. BARBER, in reply to a question as to the efficiency of the Baker heater, said we have from 175 to 180 Baker heat-

¹ Extracts from Report, Chief of Engineers, 1888.

ers in use, and so far they have been satisfactory. We have storm sashes and rubber weather strips on the windows and double floors filled in with mineral wool. Until this winter salt water has been used for circulation, but this winter fresh water is used with better results. The circulation is freer. But one Baker heater has been frozen up this winter, and that was through carelessness. He recently ran a train over the road with the thermometer 18° below zero. The car walls were filled with mineral wool, as well as the double floors. This train ran from 9 o'clock in the morning until 11 o'clock at night with no more than half a fire in the Baker heaters all day, and the cars were perfectly comfortable.

A paper sent by Mr. W. C. Baker, of the Baker Heater Co., was read by the Secretary.

Mr. ELLIS (M. M., C., St. P., M. & O.) stated that he did not see any reason why coaches cannot be heated by steam from the locomotive if the capacity of the boiler is sufficient. The size of the boiler, however, must be increased.

The PRESIDENT stated that there were but very few boilers running in that part of the country that are adequate to furnish steam for heating and to perform the work of hauling a train of 9 cars in very cold weather.

Mr. LEWIS thinks that there is not a master mechanic in the Northwest who has sufficient confidence in steam heating to start out the transcontinental trains with no reserve heater.

Mr. BARBER asked if the ordinary standard engines would furnish steam sufficient to heat a 10-car train with the thermometer 40 below and a little snow to contend with.

Mr. LEWIS thought that there was no question about it. The condensation of the steam used for heating is very slight compared with the evaporative power of a locomotive. He is satisfied that it has required no more steam to heat a train of 4 coaches after the pipes become thoroughly heated than is ordinarily used by a locomotive in keeping the pumps from freezing.

Mr. JOHNSON: The Milwaukee road runs trains of 6 coaches and 3 sleepers heated by steam, with the thermometer 25 below zero, and keeps them all perfectly warm. The trains are also lighted by electricity, by means of a dynamo, using a 15 H. P. These trains get in on time in weather 30 below zero.

Mr. BARBER: I was on that train some time ago, and was awakened at 5 o'clock in the morning to see how matters were going on. I found all the stoves in the sleepers going. The conductor said that the heating was all right until they took on the engine then running. She was not steaming very well, and so they had to light the fires in the stoves. This he said was not usually done. It was a very cold morning.

Mr. MCINTOSH (Div. M. M., C. & N. W.): There is still an element of danger with the Baker heater. When you have to crowd it to its full capacity it is possible to get too much pressure, and it will blow off at the valves and loose water out of the heater. I have known several cases of that kind to occur.

Mr. WESTCOTT suggested that it was negligence that caused the Baker heater to blow off, allowing the water in the pipes to run down and get cold.

The PRESIDENT said that in a good many cases it was purely negligence. In some cases he had found the fault in the smoke pipe. He had also found that the use of rubber valves is somewhat dangerous, and had known several accidents from them. He had taken off three rubber valves and tested them, and found that they would not blow off at 300 lbs. pressure.

Mr. BARBER: We used to have trouble until we changed the valves and put on a safety valve, set at 180 lbs. Then where the pipe comes out, we packed it with mineral wool or asbestos. We require all heaters to be blown off at least once a month and thoroughly cleaned. We fill them once a week. When we find the circulation is bad we usually discover that the trouble is with the water. We fill these heaters from the bottom. In the upright pipe we find a little space which is filled from the top. Out of the 5 heaters that I have had blow off in the extreme cold weather last winter I found the trouble in 4 cars in the cross-over pipe coming down through the floor. The pipe had been covered all except where it passes through the floor, and there it froze for a space of probably 6 or 8 in. long. After protecting this piping there was no more trouble.

Mr. BRUNSON (Supt. St. P. Union Depot): Where we have had steam heated trains in the depots it has been necessary to have the sectionmen follow them out and flange the track on account of the freezing of the water which had escaped.

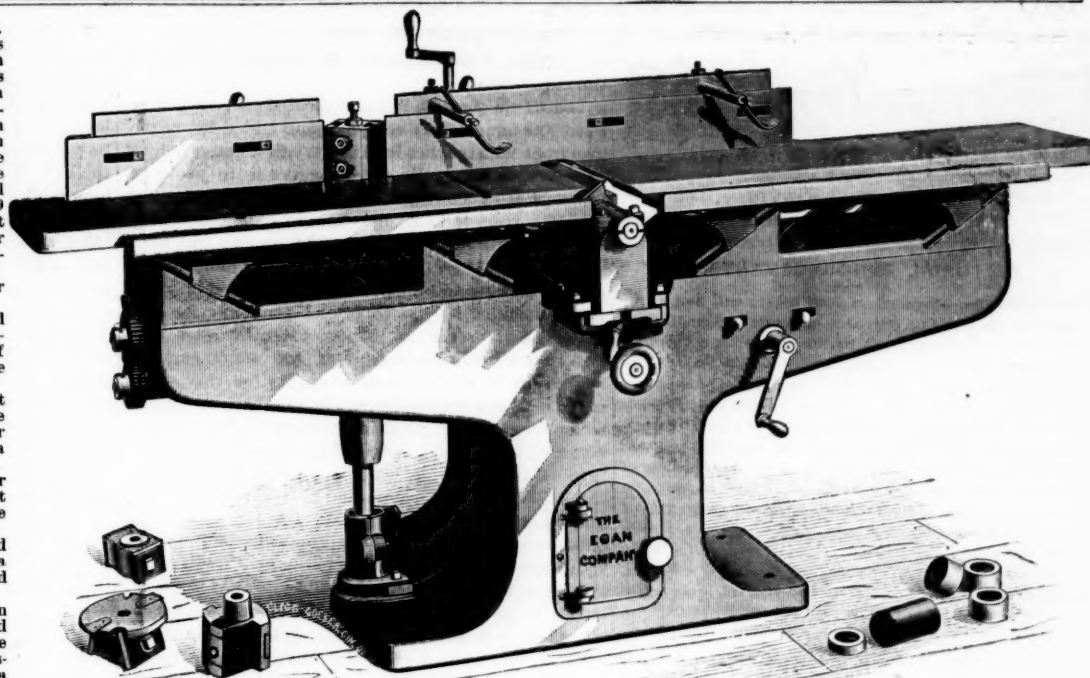
The Standard Car Heating and Ventilating Company's System.

At the last meeting of the New York Railroad Club, Mr. R. H. Soule, representing the above-named company, described briefly some of the most important features of its system. This system was fully illustrated in the *Railroad Gazette*, June 15, 1888.

Mr. Soule said: In addition to the object of economical working is another desideratum, namely, cleanliness and neatness. The drip from cars in winter weather would be a very serious thing, in so far as it is precipitated on station platforms. Having had this matter under discussion recently with an official of the Pennsylvania Railroad who is familiar with the passenger traffic in and out of Philadelphia, a simple calculation, on a conservative basis, showed that about 65 barrels of water would be precipitated on the floor of the Broad street station in Philadelphia each 24 hours. The units of calculation were the number of cars handled in the station each day (allowing each car only ten minutes in the station), and the precipitation of water of condensation at the rate of one pint per car per minute, or 60 pounds per car per hour.

An essential feature in our system is the provision of two lines of pipe under the train, one for conveying steam from the locomotive, the other for returning the water of condensation to it. This necessitates two sets of coupling connections between the cars, which at first sight may appear to be a disadvantage, but when worked out in detail proves to be an obvious advantage enjoyed by a double-line system over a single-line. In a single-line system the coupling must be made under the draw-head, with consequent dip or pocket in the line of connections. In our system the connections may be straight and level, forming no dip whatever and subject to no variation of level, except only such as is due to the motion of cars when running.

Then, again, as regards the coupling. In a single-line system the two halves of the coupling must be alike: this restriction is a serious limitation when designing the couplings. But in the return system, with two lines of connections, the two halves may be different, thus opening the way to a



UNIVERSAL WOOD WORKER.

Made by the EGAN CO., Cincinnati, O.

much wider range of design, and making it possible to introduce effective mechanical principles. We have taken advantage of this in designing our coupling, which is mapped out to give quick and easy preliminary connection, followed by a jamming action through the agency of a screw thread, which is the oldest device known to the mechanic's art for accomplishing a tight jam or joint.

Next to the coupling, the most distinctive detail of our system is, perhaps, the trap and automatic reversing valve, both of which are contained in one housing and are placed under the floor of the car. All our trains now running have a single trap under each car, but we are perfecting and preparing to introduce a double trap with two compartments into one of which is precipitated the water of condensation from the main steam line under the train, thus relieving the steam of all its water of condensation, before it passes up through the radiating system; while the other compartment receives its condensation from the radiating system proper. Both compartments blow their water of condensation into the return line, from which it is drawn into the tender through a vacuum instrument placed on the tender.

The functions of the automatic reversing valve above referred to, is to automatically, by the agency of steam pressure, shift the valve and bring the ports into register with each other, so that all the passages for the conveyance of steam and water will be properly arranged. This is necessary, inasmuch as we must be prepared to use either of our two main lines as a steam line, the other then becoming the return line.

We have also a graduating valve device for the regulation of steam in the radiating system in each car.

I may be in error, but am led to infer from remarks of the representative of the Williams Company that in their system the main steam line, the radiating system and the return line, are at all times in continuous communication with one another without the intervention of any traps whatever. Under these conditions, it would follow almost necessarily that more steam would be passed through the system than was simply necessary to heat the cars. If the entire pipe connections were subjected to the influence of the vacuum pump, it would be almost certain that that pump would draw through the pipe system of the train much more steam than was simply necessary for heating. With our system a trap is interposed under each car between the steam line and radiating system on one hand, and the return line on the other hand. No steam can pass through these traps and the vacuum instrument draws to the engine only the water of condensation and in that respect our system must be as economical as possible.

Improved Universal Wood Worker.

This new tool made by the Egan Company, of Cincinnati, O., has all the advantages of adjustment and conveniences of the builders' No. 1 machine of the same class, and in addition, has the upright head, so that two sides of the stock may be dressed at one time, and while squaring up or planing the edge can be jointed. The column of the machine is a cored casting, having a broad base, thus securing a good floor support. The main mandrel is made of cast steel and runs in three long self-oiling boxes, lined with babbit; the pulley on the mandrel is placed between two of the bearings, so that the mandrel will not become bent. This mandrel is fitted with patent adjustable bearings, by which the boxes and mandrel with head attached are moved back and forth across the machine, to suit the work desired. The main head cuts 10½ in. wide. The upright mandrel is of steel and runs in journal boxes connected to the column; it carries a four-sided slotted steel head and is driven from the same countershaft that drives the main mandrel. The jointing head can be easily removed when it is desired to use the full width of the tables for gaining, sawing, etc. The tables are of extra length and width and made perfectly true for jointing up glued stock. Each table can be raised and lowered independently of the other, or both can be raised and lowered together, either on a circle of the head or straight up and down. All these adjustments are made from the working side of the machine. The patent beveling fences are quite new, one being placed over the main head and before the jointing head; both are made in two parts, and may be moved across the full width of the

table. By an ingenious arrangement, when the fences are beveled, the lower part is always close to the table, having no forward motion. This is of great convenience and will no doubt be appreciated. The boring attachment on reverse side of machine has all the necessary adjustments for all kinds of boring, routing, rosette making, etc.

TECHNICAL.

Electric Welding Exhibition.

A public exhibition of the electric welding process was given at the station of the Malden (Mass.) Electric Co., on the evening of March 4, by the Thomson Electric Welding Co., of Boston and Lynn, Mass.

The dynamo used on this occasion had an electromotive force of 300 volts, and 100 amperes current strength. By the use of a converter these conditions were changed to 1½ volts and 40,000 amperes. The extremely low voltage renders the apparatus perfectly safe to handle, notwithstanding its remarkable heating properties.

Some fourteen tests in all were successfully made, the time required for the operations ranging from a few seconds to one minute and forty seconds. Brass, copper and iron bars ¼, ½, ¾ and 1 in. in diameter were first manipulated after being properly clamped. Larger bars then followed, also the jointing of a heavy 2-in. iron pipe. The largest bar welded was 2 in. in diameter, and the work was neatly and quickly done. Three converters or transformers were used, each of which could be instantaneously connected with the dynamo, the selection being determined by the operator, according to the sizes of the pieces to be welded. The two converters not in use were thrown out of circuit. After the welding of the small pieces they were twisted until they broke, but the fracture in no instance occurred where the joint had been made. The tests were made by Mr. Russell Robb under the direction of Mr. Hermann Lemp, electrician of the company. No attempt was made to weld dissimilar metals, although this has been frequently done by the process.

Electrical Train Indicator.

An electrical indicator for showing the progress of trains and determining their positions between stations is at present in use on several Austrian railroads. The line is divided into sections, or blocks, and at the end of each of these is placed a transmitter, which sounds electric bells at different points on the line as soon as the train passes over it. The transmitter is operated by a multiplying lever, the short arm of which rests against the lower part of the rail. The deflection of the latter under the weight of the passing train is sufficient to bring the end of the longer lever-arm against a metallic contact, and thus close the electric current. In order that only the first axle of the train may work the signal, the arrangement adopted is such that immediately after the closing of the current, the connection between battery and multiplying lever is broken and is re-established only after the lapse of several minutes. The electric bells are of ordinary construction. The receivers at the stations, however, are of special make, and are arranged with apparatus to show the relative positions of the trains. The use of this or a very similar apparatus on over 2,000 miles of the Prussian roads was mentioned in a late issue of the *Railroad Gazette*.

A New Jet Pump.

The Penberthy Injector Co., of Detroit, Mich., is offering an improved jet-pump, known as the "X.L." This device has been constructed to meet a demand for a reliable pump or ejector, designed and constructed with reference to readiness of application, simplicity in operation, durability under severe service, duplication of parts and minimum cost of repair. To accomplish this they have arranged the piping so that it is not attached directly to the pump; that is, these ejectors have independent couplings, the advantage of this being that where a thread becomes stripped the couplings can be renewed at any time. In many jet-pumps the jets or working parts form a part of the body, and when worn out the pump is worthless. In this "X.L." type all sizes above 1½ in. have independent interchangeable jets made of extra hard metal, which can be renewed at a slight cost compared with renewing the entire pump. These points are worthy of consideration because the liquids lifted and elevated by them are such in many cases as to cause rapid wear. It is claimed by the manufacturers that this jet pump will lift water or other liquid 23 to 25 ft. according to conditions and steam pressure, and will elevate water from 30 to 60 ft. All sizes are made entirely of brass up to the two largest sizes, the jets only in these large sizes being of brass.



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EDITORIAL ANNOUNCEMENTS.

Contributions.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

Commissioner Walker's acceptance of the position at the head of the Interstate Railway Association puts the whole matter on a much stronger basis than it could otherwise have had. The selection is in every respect a good one. The new organization will have extremely difficult and delicate relations both to the outside public and to the individual railroads of which it is composed. While the Inter-state Commerce law does not absolutely prevent the maintenance of effective traffic associations, it makes their task more difficult. Less can be accomplished by mere machinery, or by any regulations, however well devised. More depends upon the personal influence of the man who is at the head. In this respect Mr. Walker has a great advantage in not being identified with any individual railroad. Coming from outside, he stands in an impartial position among them all. Not less fortunate is his previous relation to the work of the Inter-state Commerce Commission. He knows how the law is likely to be interpreted more accurately than it would be possible for any outsider to do. He will be able, better than almost any other man in the country, to show how the railroads can protect themselves against the evil effects of the law without coming in conflict with its provisions. The work will be a hard one at best; but it is a satisfaction to know that it will be undertaken under the most favorable conditions possible.

"Straight Per Diem."

The vexed question of settlements for the service of freight cars interchanged between different roads is reopened with considerable vigor by an officer of the Pennsylvania system in a communication printed in another column. This letter presents some striking facts and a number of good arguments in favor of straight per diem, but it hardly does full justice to the position of the other side—the advocates of the mixed system. That position, as we understand it, is avowedly based somewhat on the necessities of the situation and not on strictly scientific principles. It is admitted it would be better for the lender to get pay for the so-called "cost of repairs" even when the car might be standing idle and not wearing out. A characteristic of the present (simple mileage) plan is that it favors small roads and short terminal lines at the expense of the larger companies. The desire of the latter to get traffic, and the division of rates, so that the longer lines get a satisfactory return for their investment, modify this in practice; but lending the cars at present rates, concession, nevertheless. Another characteristic of mileage settlements is that it puts each road upon its honor. If a borrower is honest, he pays for what he gets; but if he choose he may cheat the lender, after the manner of the practice said to be in vogue in the collection of extrabaggage money. Here, again, the desire not to break up long settled practices too violently is one of

the motives of the committee in retaining a part of the old system.

The whole question is a complicated one, and, moreover, has unnecessary complications added by nearly every one who touches it. The very first and strongest motive with most railroad managers is to avoid an increase of expenditure. In trying to carry out this aim they seem to look solely at the balances. They apparently forget the fact that if they pay out more money they are getting correspondingly more service for it. In the experiment of last year certain roads found, not that they were paying too high for cars borrowed and receiving too low rates for cars lent, but that they were borrowing too many cars and lending too few. The proper remedy for this was to make new agreements about the number of cars to be lent or borrowed; but instead of this they simply returned to the old system, which would keep their surplus cars out of sight on some foreign road instead of standing around in the way at home. The theory is that every road furnishes its proper quota of cars. If this were in fact true, it might be equitable to judge of the economy of a change in the system by noting the increase or decrease of balances; but as long as one road is a great borrower and another is a great lender there will be a clash of interests. This condition exists now, but as traffic conditions, as above alluded to, mitigate the evil somewhat, and as it is felt that the burden has been borne hitherto and therefore can be borne longer, little effort is made at reform. The reason for the clashing of interests appears in several places in Mr. Yardley's article.

It is true that the higher the per diem charge and the lower the mileage the more promptly will cars be returned. Every one recognizes that the mixed system is a compromise. But is not a compromise the true basis on which an agreement should be reached? The Trunk line committee, the Time Convention, and all who have looked at the matter fairly, have assumed that all roads are lenders and all are borrowers. If at present this is not the case, it is hoped that at some time in the future it will be. A per diem charge which covers the average daily interest and deterioration is unfavorable to the short terminal lines which borrow, because the deterioration while the cars are standing still is not so rapid as it is while they are moving. It is right that the long line, which hauls the car 100 miles while the short road would be holding it in the consignee's yard, should pay a higher rate per day, because the car is wearing out faster. The fact that the deterioration by weather and from the hard usage received in switching makes the difference between yard-wear and road-wear much less in fact than it is in theory constitutes a chief support of the straight per diem plan. The only other basis for it is the business idea that a borrowed car should be costly enough to insure its prompt return to the owner. As we have seen, the time-honored principle of favoring the borrowers is still held by the lenders with sufficient tenacity to prevent their adopting a "business idea" too completely. A car owner who makes it his sole business to lend cars must charge rates sufficiently high to remunerate him for all the time the cars are at home. This is strictly "business," but a railroad company uses its cars when they are at home, and, therefore, managers recognize that it is not fair to follow the business idea too closely. An effort to make the borrower bear a part of the burden resulting from the idleness of cars after they reach home may defeat itself by inducing him to return them too promptly. In dull seasons when there is a surplus of cars this principle appears at once. The Time Convention Committee, therefore, tried to fix a rate which should embody the golden mean that would be right at all times. Whether it will ever be found possible to accomplish this remains to be seen. Our correspondent says nobody need mourn if borrowers have to pay more nearly what cars are worth; but in point of fact, when the small roads do mourn, the sympathizing tear is found in the eye of the manager of the large road. At least this is a fair conclusion from the action thus far taken.

The criticisms based on the exceptions to the Car Service Committee's rule which have been discovered are hardly sufficient to invalidate that rule. In mentioning long roads the committee evidently meant those having long hauls; those which kept the cars a long time on the road (moving) as compared with the time spent at terminals. But it is admitted, we believe, that the long lines of the Southwest make very slow average time. Freight cars stop long enough at the ends of divisions to make a material addition to the time legitimately spent at terminals. This may explain the case of the Atchison, Topeka &

Santa Fe. The Richmond & Danville is very likely subject to similar conditions, and the Philadelphia & Reading with its immense coal traffic, which is both loaded and unloaded on its own premises, can hardly be called a road with long hauls. On the other hand, the Fall Brook Coal Company, though not a very long road, receives a very large proportion of its cars from connections in full trains and delivers them at the other end in the same manner. In this it is just as favorably situated as is the Lake Shore in hauling a car which originated at Boston and is bound for Omaha; and, in fact, we believe, takes many cars from the New York Central, hauls them 187 miles, and delivers them to the Philadelphia & Reading the same day, thus paying no per diem charge on them whatever. It remains true that, generally, the longer the road the longer its hauls.

There are other points in our correspondent's letter that might be explained, but the careful reader will readily understand them. Besides, we are not arguing against the straight per diem system. We appreciate its merits and have merely endeavored to set forth the points pro and con so that they may be seen in their true relative light.

Protection of Highway Crossings.

The last annual report of the Railroad Commissioners of Massachusetts discusses at considerable length the subject of highway grade crossings, as to the question of the separation of grades and that of the better protection of existing crossings. The report is supplemented by a very elaborate paper by Prof. Goering, of Berlin, giving a synopsis of the German law and practice in both these particulars. This paper gives also an account of the methods adopted to add to the safety of the public at stations illustrated by photographs and diagrams of several characteristic German stations. These documents, taken with the recent special report of a civil engineer commission to the Massachusetts Legislature, furnish a valuable body of information as to the means of protecting passengers and others at railroad crossings of streets and highways. In our issue of Feb. 8 the subject of separation of grades of such crossings and the special report of the engineers were briefly discussed. We shall not recur to that part of the matter here, but consider somewhat the means of protecting crossings at grade.

In any consideration of the question of the protection of existing crossings it must be borne in mind that some one must pay for safety. It adds to the fixed charges or to the operating expenses of the railroads, and as with most of them the margin between profit and loss is extremely close, the public must finally bear at least a share of any increased burden. This it may do in greater traffic charges or in less facilities. Although the relation between the liberty of the railroads to conduct business in their own way, on one hand, and low rates and large facilities on the other hand is not always quite apparent, it must be granted that it is close, and that to the freedom of the railroads of the United States from restrictions are greatly due the extent of the system, the excellence of the service and lower rates than are found in any other country in the world. On the other hand the price paid for immunity from accidents is not a dead loss, and in many cases will result in actual economy through saving costs of lawsuits and payments for damages, and by cutting off the wages of flagmen. Leaving aside all discussion of this part of the subject, we may consider the means of protection and the necessity for it.

By multiplying the whole number of trains by the whole number of grade crossings, the Massachusetts Commission gets a unit which it calls the "train grade crossing." Comparing the statistics of Professor Goering with those of the Commission it appears that in Germany the number killed and injured in crossing accidents was one to each 9.31 million train grade crossings; in Massachusetts the number was one to each 0.778 million train grade crossings, or 12 times as many as in Germany. This disproportion is so great that it becomes of much interest to examine into the means by which the immensely greater security is obtained in Germany. It is found that in Germany, out of 53,474 highway crossings, 38,659 are guarded by gates, and on those roads which have crossings without gates, the maximum speed is limited to 25 miles per hour. Moreover, any person who goes upon a crossing when the gates are closed is subject to a fine, and may be summarily arrested by the railroad police and taken to the nearest police station. The railroad police includes nearly all employes about the trains, stations, tracks and crossings. The comparative efficiency of these various precautions cannot be estimated from the statistics

given; but violation of the crossing regulations are followed by prompt and habitual punishment.

In Massachusetts but 38 per cent. of the crossings are protected against 72 per cent in Germany, and although the law permits the arrest of trespassers and authorizes the appointment of railroad employés as special police the law has been of little use because of the want of support by public opinion. While 38 per cent. of all crossings are protected, 61 per cent. of all crossing accidents were at the protected crossings. Again, the Massachusetts commissioners tell us that "by far the largest class of accidents at protected crossings are those which happen in disregard of the warning given by closed gates or by flags." In the past year the accidents of this class were 42 per cent. of all crossing accidents and 70 per cent. of all the accidents happening at protected crossings. A very important proportion of the deaths and injuries at grade crossings have been in reckless disregard of the efforts made by the railroad companies to prevent them. In view of these facts it would seem as if, instead of increasing the burden of fixed charges and of operating expenses of the roads, the next step should be to find some means to make the public take care of itself.

Something may be done for better security by extending the hours of duty of watchmen. We have often called attention to the peculiar danger of watching crossings only part of the time during which trains run over them. But much more can be done by stringent laws against crossing a track in the face of a proper warning, and by providing for the prompt punishment of persons making such an attempt. The futility of leaving it to the railroads to cause arrest and punishment has been shown. Besides their reluctance to undertake the expense of maintaining a sufficient force to act as police, they cannot with prudence risk the results of stirring up the hostility which would surely follow any interference with the inalienable right of the American citizen to commit suicide by throwing himself in front of a locomotive. The Massachusetts Commissioners recommend that it should be made a punishable offense to pass over, under or around closed gates, and that the regulations should be enforced by the municipal police.

The Commission would follow the German precedents still further, and compel a reduction of speed on such roads as do not provide crossing gates. It says that "this [reduction of speed of trains] cannot be done on any main line with due regard to furnishing proper facilities; but it is a limitation which can be applied to branch lines, and which should be applied to any new road as a uniform and necessary restriction wherever there is an unprotected grade crossing." A reduction of speed to 10 miles an hour from the whistling post to the crossing is recommended. We question the advisability of a compulsory reduction to 10 miles an hour, or, in fact, in any degree. We do not think that it would meet with popular approval, or that it would usually be found practicable. Even on branch lines and new lines the public demands, and the conditions of competition compel, speeds that make crossings dangerous. There are but few roads existing or building on which it is not necessary, in order to satisfy reasonable demands, to run at say 40 miles an hour between stations. To restrict train speeds to anything less would to a great degree nullify the objects for which the roads are built, and disappoint the public which they serve. But if trains are run at 40 miles, they may about as well be run at 60, so far as crossing accidents go. Undoubtedly such speeds should not be attempted without good track and equipment and proper signals, but we hold that these things should precede protection of highway crossings. If the admissible cost of road and of operation is limited, as it always is, expenditures must be made in the order of their importance, and the greatest amount of public good can be got out of a certain sum of money by first securing safe track and rolling stock, then signals, then crossing gates and flagman. But we question the public policy of restricting the speed on roads which are otherwise in good condition until they can afford to protect their highway crossings.

Limitation of Profits.

We believe that every dollar honestly and fairly earned by a railroad represents a service done to the public. If a railroad can increase its earning power by investing additional capital, we believe in encouraging it to do so. The money spent in improving the track gives better means of public service; the chance of making a profit in their operation is the strongest guarantee that the improvements will be utilized to their full capacity. It is not as a champion of the railroads that we defend the policy of stock issues

like that proposed by the Boston & Albany, but because we believe that the public interest is best served thereby.

Those who try to restrict railroad profits commit, on a small scale, the error which the extreme socialists carry out consistently. The socialist counts up the gains of the investor, and then says, "How much better off the workmen would be if this extra profit could be divided up among them." He does not see how the chance for profit has furnished an incentive to the best use of capital, and how, in the absence of that stimulus, far more is lost in efficiency than could possibly be gained by the distribution of a considerable sum of money. The effort to limit railroad dividends, as far as it goes, involves the same error. It takes away all motive to develop new business. But the desire to develop such business has been the most potent factor in reducing rates. Take it away, and you tend to keep rates up rather than to lower them. By trying to prevent a railroad from dividing all it can earn, you defeat your own purposes. A more penny wise and pound foolish policy could hardly be imagined. An analogy will help to make this clear. In any customs tariff, the maximum revenue is produced by a moderate rate of duty, not high enough to check importations. The amount collected may be reduced either by making the rate so low as to give little revenue on each invoice, or so high that little will be imported. The same alternative exists when a railroad is forbidden to divide all it earns. It may avoid accumulating a surplus, either by putting rates down or by keeping them up. Either doing a large business at low rates, or a small business at high ones. The public assumes that the former alternative will be chosen. In point of fact, the latter is all but universal. Limitation of dividend prevents reduction of rates, instead of stimulating it.

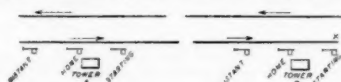
This is no mere theory. It rests on actual experience. The plan of limiting dividends has been more widely tried in England than in America. Sir Thomas Farrer, for a long time Secretary of the Board of Trade, and the highest authority on the subject in Great Britain, if not in the world, does not hesitate to pronounce the attempt a complete failure. He says that "in Parliamentary limitation of dividend they have gone on a wrong tack and involved themselves in a maze of absurdities;" that "the principle is in itself faulty;" that "so long as the charge is not too high the public have no interest in the reduction of dividend; their interest is in the reduction of price, which is a totally different thing. The fallacy lies in supposing that what is taken from the shareholders necessarily goes into the pocket of the consumer. It does no such thing." This is the result of thirty years' practical experience in the effort to control corporations in England.

Whether it be possible to attach some conditions to the new issues of stock which shall protect the public interests is quite another question. It is quite possible that there is room for action of this kind. However far-sighted a body of railroad managers may be, they feel their duties to investors more directly than those to the public. Proposals for special legislation on behalf of the public interests must be judged in detail on their own merits. But we are confident that the general attempt to oppose the increase of railroad profits as such can do nothing but injury.

A Point in English Practice with Block Signals.

A correspondent, "C. H. K.," asks "whether any English railroad has adopted the form of block system which requires two blocks and two signals between consecutive trains, in order that an engine which may have overrun a signal in a fog may not collide with a preceding train which may have broken down or stopped a few feet in advance of this signal."

The requirement that there shall be two signals is very common, the arrangement being as shown by the diagram; but keeping trains two full blocks apart is, so far as we know, not in use to any extent. We



take it that our correspondent means block sections of the usual length—100 rods to two miles. The Board of Trade regulations for block signaling are not very clearly defined, but what the inspectors insist upon for an absolute block is that "line clear" shall not be given for a following train until a preceding train is protected by a distant, a home and a starting signal, so that there is no danger of a rear collision when for any reason an engine overruns even his home signal for a considerable distance.

In the diagram (in which, by the way, the trains are represented as running on the right hand

track, contrary to the well-known English practice), the operator at B is only permitted to give line clear to the operator at A, when the tail or last car of a passing train has gone beyond the point marked X, so that for a following train to collide with the preceding one, supposing it to have stopped at the point X, the engineman must run past the distant, home and starting signal of B, all three at danger. Anything less than this is not deemed absolute block. It will be observed that admittance to the block section is controlled by the starting signal. The home signal, which often or usually has for its chief office the protection of the switch for a cross-over or side track located between it and the starting signal, serves to give the latter two cautionary signals.

By this requirement most or all American block signals would be found wanting. American officers are thought by expert critics to grudge the money spent for a single distant or cautionary signal, not to mention a double protection; and the practice seems to justify the criticism.

The most common form of block arrangement here is (1) the location of the starting signal immediately at the station office, or (2) just short of, or (3) just beyond it. With the first or second method, if the train comes to the station to do its work before the whole of the block ahead is clear, the engine gets beyond the control of the operator. With the third, and also with the first, a whole block in the rear must be kept open while a train is at the station, thus causing more or less delay at stations where trains make stops of any length. This where no caution signal is provided. With a distant caution signal and only one positive stop signal there is a temptation to treat the distant as something more than a caution signal; to occupy the track between it and the positive signal, depending upon approaching enginemen to not only obey the caution signal after they reach it, but to bring their speed under control some time before reaching it. Under the English system, indeed, a train cannot stop to do work between the home and starting signals without keeping trains back a whole block; but this difficulty is met by a provision for admitting trains to blocks with the warning that there is "A train at the station" at the farther end of the block. This better than a mere vague caution signal.

In reporting on a crossing collision which occurred on the Metropolitan (underground) road in London, Jan. 2, 1888, Major Marindin recommended that at a crossing or junction the trains on conflicting routes should not be allowed to approach simultaneously. He follows this up with a recommendation for an additional block station, and undoubtedly regards the length of a whole block necessary for the protection of trains on a crossing. In other words, he deems ordinary home and distant signals insufficient protection for such a place. The crossing reported on in this particular case was, however, somewhat peculiar. The accident was reported in the *Railroad Gazette* for July 13 last.

Freight Statistics of Prussian Railroads.

In our issue of Feb. 15 we gave some facts with regard to the proportion of different kinds of traffic on the Prussian State Railroads. We are now able to present figures in detail, of a more recent date. These new figures fully confirm our previous conclusions. As the percentages rather than the absolute results are of special importance, we have not reduced them to American weights and measures, but give them in metric tons (of 2,204 lbs.) and kilometres (about $\frac{1}{2}$ of a mile). The German freight statistics do not include shipments of live cattle, which are reported separately.

It should be borne in mind, in comparing German with American practice, that the "normal tariff" of Germany is arranged very nearly on the equal mileage basis; and that anything which departs from this system is counted as "exceptional." At the same time, the difference in ton-mile rates shows that the departure of the exceptional tariffs from the corresponding normal ones is quite considerable; some of them, as we showed in our previous issue, having gone so far as to violate the short-haul principle.

The tables group themselves under three heads:

	I. TONNAGE.			
	1886-7.		1887-8.	
At normal tariffs.	Tons.	Per cent.	Tons.	Per cent.
Express.....	340,000	0.3	330,000	0.3
Parcels.....	1,122,000	4.5	3,881,000	3.9
Half car-loads, general.	1,041,000	1.1	1,117,000	1.1
Car-loads, ".....	1,596,000	1.7	1,730,000	1.7
Half car-loads, special..	2,531,000	2.8	2,128,000	2.2
Car-loads, ".....	37,619,000	40.9	40,647,000	41.1
At exceptional rates.				
Less than car-loads....	235,000	0.3	791,000	0.8
Car-loads.....	44,453,000	48.4	48,374,000	48.9

Some of these changes are due to alterations in the tariff itself. The most important was one by which parcels goods of certain classes were carried at exceptional rates. To this is doubtless due the great increase in L. C. L. exceptional, and the corresponding decrease in parcels normal and half carloads specials. Apart from this, which represents a transfer rather than a growth, practically the whole increase

of tonnage has been in goods carried at special (i. e., sharply classified) or exceptional carload rates.

II. FREIGHT MOVEMENT.

	1886-7.		1887-8.	
	Ton-kilometres.	Per cent.	Ton-kilometres.	Per cent.
At normal tariffs.				
Express.....	51,024,000	0.5	48,150,000	0.4
Parcels.....	536,138,000	4.8	519,356,000	4.3
Half car-loads, general	184,212,000	1.6	199,765,000	1.7
Car-loads, general.....	320,221,000	2.8	354,828,000	2.9
Half car-loads, special	287,252,000	2.5	259,358,000	2.2
Car-loads, special.....	3,993,712,000	35.5	4,672,620,000	38.6
At exceptional rates.				
Less than car-loads.....	28,863,000	0.3	110,983,000	0.9
Car-loads.....	5,855,875,000	52.0	5,925,096,000	49.0

The total increase in ton-kilometres is 7.1 per cent., the aggregate being 12,090,196,000 in 1887-8, against 11,257,297,000 in 1886-7. Curiously enough, in Germany, as in America, this has been accompanied by a slight decrease in average haul. The average haul amounted to 122.45 kilometres in 1886-7 and 122.13 kilometres in 1887-8, about 76 miles in either case.

As these figures cover only 22,466 kilometres, or a trifle over 14,000 miles of railroad, they represent a somewhat greater density of freight traffic than exists in America.

III.—REVENUE.

(In this table, which is for 1887-8 only, we have made the reduction to American standards.)

	Total.	Per cent.	Per ton of mile.	
			2,000 lbs.	cents.
At normal tariffs.				
Express.....	\$2,800,000	2.5	\$7.78	8.4
Parcels.....	15,100,000	13.5	3.56	4.2
Half car-loads, general	3,500,000	3.2	2.90	2.6
Car-loads, general.....	5,500,000	4.9	2.90	2.3
Half car-loads, special	3,500,000	3.2	1.53	2.0
Car-loads, special.....	38,000,000	34.1	0.88	1.2
At exceptional rates.				
Less than car-loads.....	2,100,000	1.9	2.42	2.8
Car-loads.....	40,800,000	36.7	0.77	1.0

The average receipt per ton-mile on all classes of goods was about 1.34 cents, the reduction in rates from one year to the next being merely nominal. The inclusion of the express business tends to raise these figures, but the omission of the cattle business lowers them. The two effects nearly balance, so that there is no unfairness in making a direct comparison of this average with that of other countries.

The Insurance Clause in Bills of Lading.

In the *Railroad Gazette* of May 4, 1888, there appeared a brief review of the legal decisions on the subject of the insurance clause in bills of lading, which was widely commented upon. The decisions of all the courts cited up to that time, sustained the right of carriers to insert such insurance clauses, and declared them valid defenses against suits to recover under the common law. The New York Court of Appeals in the *Platt* case, decided Feb. 10, 1888; in *Rintoul vs. N. Y. C. & H. R.* (Circuit Court for Southern New York, May, 1884); and in *Phoenix Insurance Co. vs. Erie & Western Transportation Co.*, the United States Supreme Court (March, 1886), all favor the carrier's position.

A later decision of the United States Supreme Court in the case of *Inman vs. South Carolina Railway*, decided last January, however, seems again to leave the vexed question open. In this case the subrogation clause in the bill of lading was the only defense. Chief Justice Fuller, in the opinion, said that if the owner had collected from the insurance company he could not collect again from the carrier, and that the clause could not avail as a set-off unless the owner had taken insurance which he could make available to the carrier. As to ultimate liability the carrier is in legal effect primary and the insurer secondary, hence the insurer could under their contracts require the owner to pursue the carrier in the first instance and decline to indemnify him until the measure of the carrier's liability was determined. This the insurer did, and the carrier is not entitled to object. The defense based on the insurance clause in the bill of lading was accordingly overruled.

The same principle appears in the case of *Law Assurance Co. vs. Oakley*. The insurance company paid Oakley for a loss caused by a gas explosion; Oakley also recovered for his loss from the gas company, whereupon the insurance company brought an action and recovered the money paid to Oakley. The intention seems to be to hold the insurance company responsible only where no one else is liable under the common or statute law, thus holding the carrier in spite of the bill of lading clause. It cannot be said that this is clearly the case, for weighty authority, as we have seen, is on the other side. But this latest decision of the United States Supreme Court looks in that direction.

Within the last year a system of piece-work has been generally adopted in the car repair shops of the Pennsylvania lines (west of Pittsburgh). A scale of prices is fixed for the various parts of the cars of the system, and of those foreign cars which are repaired in considerable numbers. For odd cars, which are not numerous enough to form classes, no special scales are attempted, but arbitrary prices are paid which probably work out pretty fairly in the average. The plan seems to work satisfactorily all around. The men earn better wages than they got under the system of payment by time, and the work is done cheaper. Repair shops offer great chances for soldiering, and a practicable system of piece-work must be an important gain in economy.

The Lehigh Valley has given an order for 10,000 tons of rails to be cut with mitred ends. It is known that a small

experiment with this form of joint has been carried on for some time on that road, and this considerable order shows that the results have not been discouraging. We have, however, no particulars of these results. There have lately come to light on that road a few iron rails with mitre cut joints, which were laid in 1869, and had four or five years of hard service, under heavy traffic. They have since been in use as guard rails on a bridge. An examination of these iron rails shows them to be as perfect at the ends as at any portion of the rail.

The Baltimore & Ohio Fast Train between Washington and Philadelphia.

The new arrangement of the Baltimore & Ohio for a fast train service between New York and Washington by the Bound Brook route went into effect the 10th inst. One south bound train is to make the run in 5 hours and 45 minutes and two others in six hours. In view of the new departure it may be interesting to know just what the Baltimore & Ohio has lately done with its regular trains between Philadelphia and Washington.

Previous to November, 1888, the fastest schedule time of regular trains between Philadelphia and Washington was made by the Pennsylvania in 3 hours and 25 minutes. The Baltimore & Ohio, on Nov. 18, shortened its train time to 3 hours and 15 minutes. The Pennsylvania afterward reduced its time to 3 hours and 7 minutes, 9 minutes and 10 minutes for various trains north and south. The fastest train now running on the Pennsylvania from New York to Washington makes the run in 5 hours and 32 minutes.

The distance between Philadelphia and Washington by the Pennsylvania route is 137.6 miles; stops are made at Baltimore and Wilmington. The average speed of the fastest train is 43.6 miles per hour for the entire trip, with no deductions for stops, etc. Water is taken from track tanks, and the trains pass through tunnels under the city of Baltimore.

Since Dec. 9, 1888, three fast trains daily have been run between these points, on the Baltimore & Ohio, in 3 hours; one southward and two northward. The distance by the Baltimore & Ohio is 133.4 miles by rail, and a mile or so ferriage across the harbor. These trains do not run into Camden Station, Baltimore, but pass a little less than a mile to the south at Bailey's engine house, where connection is made with Camden Station. The trains usually consist of three cars and a Pullman parlor car. No stops between Baltimore and Washington are made.

From the arrival of the trains at Locust Point to their departure at Canton, across the harbor, or vice versa, 10 minutes is allowed. The entire train is run upon the large steam ferry-boat, "John W. Garrett," without breaking couplings, and during the trip across, which takes, from start to stop, about 7 or 8 minutes, the tender is filled with water, pumped out of tanks carried on the boat. From Canton to Philadelphia, the distance, 91.6 miles, is run in 2 hours by the three trains, and two stops made, the first at Newark, distance 55.4 miles, where 4 minutes are consumed in taking water, and the second Wilmington. The time of the train, known as the "Flying Yankee," given below, represents very closely the movements of the other two.

Miles.		Time.
0	Washington.....	iv
1	Metropolitan Junction.....	pass
38.4	Carrolls.....	pass
39.2	Baileys.....	iv
41.8	Locust Point.....	ar
96.2	Canton.....	iv
96.2	Newark.....	ar
108.3	Wilmington.....	iv
133.4	Philadelphia.....	ar

The average speed, with no deductions for stops or ferry, is 44.5 miles per hour. The actual time lost by stops at stations and by ferry is 15 minutes, making the actual time in motion 165 minutes, and the average speed 48.5 miles per hour. Leaving Washington, the first mile to Metropolitan Junction is run in 3 minutes, and entering Baltimore from Carrolls to Baileys, 0.8 miles, 2 minutes are consumed; the actual running time between Metropolitan Junction and Carrolls is 37 minutes, and the distance 37.4 miles; average

rate of speed, 60.6 miles per hour. From Canton to Newark, 54.4 miles, is run without a stop in 66 minutes; average speed, 49.4 miles per hour. The engines run through without change, and the trains move with great regularity; the percentage of those not arriving on time is very small. In the following table the data given above are summarized:

	Distance in miles.		Speed, miles per hour.	
	Including stops.	In motion.	No stops.	Deducting 2 min. for each stop for losing and gaining head-way.
Washington to Philadelphia.....	133.4	44.5	48.5	50.9
Washington to Baltimore.....	39.2	39.2	56	58.8
Met. Junc. to Carrolls.....	37.4	37.4	60.6	60.6
Canton to Newark.....	54.4	54.4	49.4	51.0
Canton to Philadelphia.....	91.6	45.8	47.4	50.0
Wilmington to Philadelphia.....	25.1	25.1	59.2	53.7

Relative Tensile Strength of Plain and Twisted Iron and Steel Bars.*

The experiments, as indicated in the annexed tables, were made to determine the difference, if any, in the tensile strength of iron or steel bars in their normal condition or with a certain amount of twist. The bars tested in Tables I., II. and IV. were of refined iron, and in Table III. of mild steel, such as is used for rivets in the Government cruisers building at the Union Iron Works. The material was all manufactured at the Pacific Rolling Mills. In order to secure as accurate work as possible, the test pieces in each table were cut from the same bar and numbered consecutively; and after being prepared as described below, and before twisting, they were accurately measured and divided into groups of two each, according to similarity of diameters.

The testing was all done by the same person. One group of each set was twisted until the pieces broke, as a guide for the amount of twist to be given to those to be tested for tensile strain.

The torsional strength of square and round bars being as the cubes of their sides and diameters respectively, $\frac{3}{4}$ in. bar was used in all cases, for similarity of results.

It was shown by the experiments in Table IV. that square bars when tested without shoulders invariably broke in the clamps of the testing machine. Therefore, in the second set of experiments, with square bars (Table II.), they were slotted on two opposite sides to a depth of $\frac{1}{16}$ in. in order to determine the breaking point between the shoulders. The round bars were all turned down about $\frac{1}{16}$ in. on the twisted portion. In I. and II. the length of the twisted part is 8 in., in III. and IV. it is 12 in.

The testing as shown in III. and IV., the first made, was not satisfactory for several reasons, as given above.

From each lot, two pieces without twist were tested for tensile strength and ductility, as shown in the tables. The two in each of the groups were then carefully given a number of turns in a lathe worked by hand power. In placing the twist, one end of the test piece was held fast, the other being clamped to the face plate of the lathe. The twist was then made from the end next the lathe, and at first it seemed to be a decreasing one toward the other end of the bar. But when all in, no difference in the pitch of the twist could be measured. In some of the round specimens, measurements were taken to discover any difference in the diameters after twisting, but the results were doubtful. There is a certain distortion of the pieces, both in sectional area and longitudinally, but this was probably due to the difficulty of holding the pieces in a fixed longitudinal position while being twisted. Unwin states, "There is no difference in length or in transverse section after torsion."

Measurements for ductility and reduction of area were, made only on the untwisted bars, to show the general quality of the material. An attempt was made to determine the elastic limit of the twisted bars, but they all appeared to have a certain spring in them due to the twist, and the results were thrown out as unsatisfactory. The testing was all done on the same day that the twist was placed in the bars.

The first strain was well within the elastic limit, about 20,000 lbs. to the square inch. Weight was then added of about 3,000 lbs. per square inch, at intervals of about 20 seconds, until 50,000 lbs. was reached, when the pieces were broken by the addition of about 1,000 lbs. per square inch until near fracture, when small increments were added.

As stated above, the results in I. and II. are the most complete, although the tests in III. and IV. were carefully made. It is unnecessary to refer to the change in tensile strength of the bars, as it is shown in the tables. A brief reference will be made, however, to the behavior of a few of the pieces. In IV., when the square bars were tested without shoulders, all broke in the jaws of the machine, as did also some of the pieces with shoulders, in Table II.

With two sides of the bar slotted to a depth of one-sixteenth inch, and a width, say, of 0.750, as in Table II., we

* By Lieut. F. P. Gilmore, U. S. N., before the Technical Society of the Pacific Coast.

I.—IRON THREE-QUARTER ROUND, LENGTH OF TWISTED PART 8 IN.

Number.....	1	3	2	4	6	7	8	9	10	11	5	12
Twist in turns.....	0		$\frac{1}{4}$			1		2		$2\frac{1}{4}$	$4\frac{1}{4}$	$5\frac{1}{4}$
Diameter.....	.719	.719	.718	.718	.719	.719	.718	.720	.719	.719	.705	.713
Area.....	.4060	.4060	.4049	.4049	.4060	.4060	.4049	.4071	.4060	.4060	.3994	.3993
Tensile Gauge.....	22,000	22,000	23,900	23,900	25,600	25,000	26,200	26,400	26,400	26,400	†	†
Tensile, square inch.	54,180	54,180	59,020	59,020	63,000	64,000	64,700	64,800	65,000	65,000	†	†

* Broke in clamps of testing machine. No. 6 broke again in the middle at 66,000 pounds per square inch. No. 9 broke again in clamps at 66,800 pounds per square inch, and again between shoulders at 67,300 pounds per square inch.
No. 1 Elongated in 8 in. 27.75 per cent. Reduction of area 41.5 per cent.
No. 3 Elongated in 8 in. 27.75 per cent. Reduction of area 41.5 per cent.
† Twisted until broken.

II.—IRON THREE-QUARTER SQUARE, LENGTH OF TWISTED PART 8 IN.

Number.....	3	5	1	6	2	4	7	12	10	11	8	9
Twist in turns.....	0		$\frac{1}{4}$			$\frac{1}{2}$		1		$1\frac{1}{4}$	3	$2\frac{1}{4}$
Width.....	.752	.751	.752	.749	.752	.751	.752	.753	.750	.753	.750	.753
Thickness.....	.614	.615	.606	.618	.625	.617	.623	.616	.620	.620	.611	.620
Area.....	.4617	.4618	.4537	.4629	.4700	.4634	.4685	.4638	.4630	.4667	.4582	.4667
Tensile gauge.....	25,900	25,200	26,400	26,200	27,200	27,000	28,000	30,000	30,000	30,000	30,000	30,000
Tensile, square inch.	56,000	54,560	57,930	56,000	57,900	58,260	61,000	65,330	66,230	64,280	†	†

* Broke at shoulder. No. 10 broke again at shoulder at 67,520 lbs. per sq. in. † Nos. 8 and 9 twisted until broken.

have an area of .094 square inch, taken from the bar. With a tensile strength of 55,000 lbs. per square inch, this gives a value of at least 5,000 lbs. which the bars have gained in strength, when they broke in the clamps. The bars were so held that these fractures were not due to compression in the jaws of the machine. Several of the bars which broke in the clamps were rebroken (No. 9 in I., a second time rebroken), and always gave an increase of tensile strength. Numbers 8 and 10 in I., broke with no snap, and seemed in a manner to twist off rather than pull apart. No. 4 in II., had a long crack in it, due to the lamination of the iron, but the results of pieces 2 and 4, same group, are similar. Attention is called to the number of turns required to break the steel bars—thirteen.

In the steel bars more satisfactory results would have been obtained had more twist been given to some of them. But III. and IV. indicate the same general law as I. and II.

III.—STEEL, $\frac{3}{4}$ IN. ROUND, LENGTH OF TWISTED BAR 12 IN.

Twist in turns.....	0	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	1	13
Tensile, sq. in.....	57,000	57,630	57,630	59,250	59,250	Broke.
Tensile, sq. in.....	57,630	57,900	51,900	57,390	57,390	Broke.
Elongation in 12 in. 28.33 per cent. = 32.75 per cent. in 8 in.						

IV.—IRON, .76 IN. SQUARE; AREA, .5776; NOT DRESSED.

All twisted pieces broke in clamps.

Twist in turns.....	0	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	1	7 and 11
Tensile, sq. in.....	52,460	54,190	53,150	53,670	53,670	Two pieces.
Tensile, sq. in.....	52,630	53,670	53,670	53,670	53,670	Two pieces.
Elongation in 12 in. = 27.33 per cent.						
* Broken again at 55,920 lbs. per sq. in.						
+ Broken again at 60,000 lbs. per sq. in.						

Coal Waste and Some Remedies.

A government publication entitled "Mineral Resources of the United States" gives the marketed output of coal for 1886 as 107,682,209 tons, of which amount 36,696,475 tons were anthracite. According to the United States census, in the anthracite coal fields 33.6 per cent. is marketed, 54.8 per cent. is left in the mines as pillars, etc., and 11.6 per cent. is lost in cutting, breaking and screening. Thus, for 36,696,475 tons marketed, 73,000,000 tons were lost. The total amount of anthracite marketed from 1820 to 1886 is estimated at 641,904,347 tons, showing a loss, during this period, of 1,250,000,000 tons.

The data for the losses occurring in mining bituminous coal are less full, but it will be fair to assume the loss from pillars at 40 per cent. and from slack 20 per cent., making 60 per cent. in all, and amounting in 1886 to 106,000,000 tons for a 70,980,724 tons marketed. Bituminous coal is subject to another loss from exposure to the atmosphere, as much as 50 per cent. of its heating power being lost from this cause.

In the manufacture of coke, the losses are very large. Thus, in 1885, the total output of coke was 5,106,692 tons, which required for its production 8,071,126 tons of coal, showing a loss of 2,964,430 tons. Each ton of coal contains about 5,000 cu. ft. of combustible gas; and, as it has been proven that 1 lb. of gas (23.5 cu. ft.) will evaporate 20.31 lbs. of water, the loss in gas by the coking process is equal to the evaporative power of 1,743,363 tons of coal—assuming that 10 lbs. of water can be evaporated by the combustion of 1 lb. of coal. The loss with oven coke, from dust or breeze, is estimated at 4 per cent., which would amount to 806,383 tons on the whole product of 1885.

In gas house manipulation, the volatile gases (with the exception of that contained in the tar) are saved. Tar is said to contain 12 cubic feet of combustible gas per pound. This tar is sold by the gas companies at a nominal figure and the loss thereby resulting is rendered plain by the following comparison. A ton of ordinary coal yields from 8,000 to 11,100 cubic ft. of gas, canal coal 15,000, while tar should yield more than 20,000 cubic ft. of gas per ton. The gas companies lose from dust or breeze about 2.7 per cent., or 1 bushel of 70 pounds in every 36 bushels of coal used.

The loss in mining coal and manufacturing coke does not cease with the waste of the material itself, but extends to the expenses incurred for wages, mining material, royalty, loss of profit, etc. The marketed coal is subject to still further losses from the carelessness of those using it.

In treating of the losses incurred in the use of coal it may be premised that the theoretical mechanical energy set free in the combustion of one pound of pure carbon is 11,000,000 foot-pounds, sufficient for the work of one horse-power during a period of 5 hours and 33 minutes; or, in other words, an indicated horse-power, which requires 10 or 12 lbs. of coal hourly, in ordinary non-condensing engines, and rarely falls below 2 lbs. in the most economical engines, should be produced by the hourly consumption of $\frac{1}{3}$ lb. of pure carbon, or about $\frac{1}{4}$ lb. of ordinary coal.

Some notes on the waste of coal by locomotives are taken from the reports of the Canada Southern, Michigan Central, Hannibal & St. Joseph, and Lake Shore & Michigan Southern Railroads, from which it appears that the coal used in passenger service for each passenger carried one mile varied between 1.16 and 1.86 lbs. On freight trains the fuel consumed for carrying one ton gross weight one mile, including the coal used in switching, varied between 2.75 and 6.4 ounces; or, deducting the latter item, the average coal consumption per ton-mile was:

Canada Southern.....	2.3
Lake Shore.....	2.38
Michigan Central.....	3.52
Hannibal.....	5.76

Theoretically, 2.3 ounces of coal would be sufficient to haul one ton 28 $\frac{1}{2}$ miles.

Even with well designed steam-generating plants, serious losses occur from improper firing. A striking illustration of this statement is detailed as follows: "Latterly, at Magdeburg, Germany, there was a stoking competition held, at which only firemen who had several years' practical experience were admitted to the test. In all eleven stokers competed, under as near as possible similar conditions. The evaporation obtained per pound of coal by the eleven stokers varied from 6.89 to 4 lbs. of water, and with lignite from

2.32 lbs. to 0.95, being a difference of 44 and 63 per cent. respectively. Such differences are very startling."

The use of wet coal is another source of waste. It has been demonstrated that coal with 18 per cent. of water evaporated 5.7 lbs. of water per pound of coal, while the same kind of coal with only 3 per cent. of water gave an evaporation of 8.5 lbs.

In burning dust or pea coal the loss often amounts to two-thirds of the coal in comparison with results obtained by the use of larger coal.

Badly constructed machinery occasions a great waste of coal. A line of shafting making 300 revolutions a minute will waste a large amount of power by the interposition of slight resistances. Thus a load of 10 lbs. on a 3-ft. wheel will consume one horse-power, and more than this load is often put on a pulley by a light belt left dragging.

The loss of fuel in the smelting furnace will next be considered. Assuming iron to have a specific heat of 0.114 and the welding heat temperature to be 2,900 deg. Fah., 331 heat units are required for one pound of iron, and since a pound of carbon develops 14,500 heat units, and a pound of ordinary coal about 12,000, one ton of coal should bring 36 tons of iron to the welding temperature, while in practice one ton of coal only heats 1 $\frac{1}{2}$ tons of iron, and produces but $\frac{1}{2}$ part of its maximum theoretical effect. In melting steel, at an assumed temperature of 3,600 deg. Fah., and a specific heat of 0.119, 428 heat units would be theoretically required to melt 1 lb.; and if the heat-producing power of a pound of coke is 12,000 units, 1 ton of coke should melt 28 tons of steel, but actually melts only $\frac{1}{2}$ of this amount in the pot furnace. The yearly waste of coal in blast and other varieties of furnaces is enormous.

The waste of coal in domestic consumption is well known, whether the coal be used in open grates, where the radiant heat alone is utilized and the combustion is usually imperfect on account of the excessive air supply, or in the ordinary stove which, though much more economical than the grate, is quite wasteful of fuel.

The foregoing statement of the causes of loss in the use of coal, while by no means complete, covers most of the principal items; and some means of diminishing these losses will next be considered.

In the mining and preparation of coal for the market, it is only possible to consider the subject generally, since local circumstances frequently control the arrangement of machinery and management of particular mines. Coal can be mined without the loss occasioned by pillars, by the "Long Wall," the "Long Wall," and the "Shropshire" systems of mining, in cases where material required to fill up the "Gobbs" (or excavation) can be conveniently procured. The "Panel" method is also more economical than the plans in ordinary use. The losses caused in cutting or gaining the coal can be reduced by the employment of improved machinery, and by taking care to confine the effects of the blasting to the correct fracture of the coal. The loss from screening can only be reduced by applying methods to utilize the slack and dust. The waste caused by exposure of the coal can be prevented by providing suitable shelter, except in the case of lignite, which disintegrates rapidly, even when under cover. The means of preventing loss from the latter cause will be considered under the head of methods for utilizing slack.

The gases lost in the coking of coal can be saved, in great part, by conducting the process in a German *shachtofen*, which is made in the form of a bottle, and is tightly closed during the coking process. The unconsumed gases generated in the coking, escape into a condenser, and are saved.

The gas contained in the tar made by gas works can be generated and utilized by injecting tar into a retort containing pieces of brick or coke in a state of ignition.

The large amount of slack and dust made at coal mines has developed many plans for utilizing it in the furnaces of stationary and locomotive boilers. In one form of slack burners, the grate bars are placed very close together and a forced draft is employed; but this arrangement is not very successful, because if the bars are placed so close that no coal or dust will fall through, it is difficult to supply sufficient air for combustion. The fine coal, also, under these circumstances, is apt to fall together into such compact masses that its combustion is difficult. Should a very powerful blast be used for the purpose of overcoming these difficulties, much of the coal is blown out of the furnace unconsumed. Moreover, in cleaning a fire, by withdrawing every alternate grate bar, there is a great waste of unconsumed coal. It has been proposed to inject fine coal into a furnace and burn it while in transit; but this plan appears to be impracticable, since even the infinitesimal particles of carbon in smoke cannot be thus burned.

Numerous attempts have been made to produce a cheap and economical fuel by cementing the slack and dust into bricks or lumps. The only material which has been used commercially for this purpose, is pitch; and it is safe to assume that at least ten per cent. of the artificial fuel must be composed of pitch, whose minimum cost is eight dollars per ton. This would make the cost of the pitch 80 cents per ton of fuel, to say nothing of the other expenses connected with the manufacture. Pitch cannot be regarded as a good cement, since it becomes liquid at comparatively low temperatures, and produces considerable smoke and odor in burning. Hence, when used with anthracite and non-caking coal, the fuel would become disintegrated as soon as the pitch became liquid. When used with caking or coking coals, the pitch might hold the masses together until they become compact by caking; but even in this case, the cost of manufacture, the smoke smell, and deposits in boiler tubes, are serious objections.

Although the methods heretofore employed to cement slack and dust into bricks or lumps have been far from successful,

it has been chiefly on account of using a wrong material to form the solid masses; because the waste products from coal mines can in all probability, be utilized only when compacted. The requisite provisions for a cheap and suitable material to bind the small particles of coal together can be readily summarized. It should not render the coal less combustible; it should hold the particles of coal firmly together, under all conditions of practice; should be cheap and abundant; and should not alter the carbonaceous matter upon which it is used, whatever be the variety of the coal. All these conditions seem to be fulfilled in *silica*, or common sand, which is a natural binder, is unaffected by any ordinary temperature of combustion, is practically unaffected by the atmosphere, and is soluble only in hydrofluoric acid.

A reference has already been made to the enormous waste of fuel in the production of steam power, and a comparison has been made between the fuel consumption of wasteful and economical steam engines. For a further comparison, suppose two steam cylinders of the same internal dimensions, the first using steam admitted by a simple slide valve, and without condensation, and the other being provided with the Corliss variable expansion gear and a condenser. If the initial pressure in each cylinder is 60 lbs. per square inch above the atmosphere, and each engine has the same load, the second cylinder will only require one-third as much steam per stroke as the first. By compounding the engine, jacketing and lagging the cylinders and superheating the steam exhausted from the first cylinder, still greater economy can be obtained. Engines built on this plan have consumed as little as $\frac{1}{2}$ lbs. of coal hourly per indicated horse power, and this figure may be still further reduced; but it is doubtful if an engine and boiler operating with the economy indicated by theory will ever be constructed.

Much fuel is wasted in the furnaces of steam boilers, by reason of imperfect combustion, which produces smoke. Once made, smoke cannot be consumed economically, but its production can easily be prevented. The most smoky fuels are coal oil and similar chemical products, yet these are burned without smoke in an ordinary lamp, unless the wick is raised too high. Similarly, in the boiler furnace, if the fire is not forced too much, there will be no smoke and the greatest economy will result. If steam users would provide ample boiler power, so that sufficient steam could be generated without forcing the fires, and would offer premiums to the firemen for careful management, not only would the smoke nuisance be overcome, but a large saving would be effected in coal bills.

Locomotives give the best results with a moderately heavy fire, thicker towards the back than the front. The coal should be fired at the front, and not pushed back until it has become thoroughly heated, and the fire should be cleaned about every four hours.

The various methods of diminishing the waste of coal in domestic consumption need not be considered here, but great saving in this direction can yet be made by the use of better designed stoves and grates.

TECHNICAL.

Locomotive Building.

The Louisville & Nashville last week ordered seven more consolidation freight engines from the Rogers Locomotive Works, at Paterson, N. J. They are to be received within 60 days.

The Anniston & Cincinnati has received ten new mogul engines from the Baldwin Locomotive Works.

The Lynchburg & Durham has just received from the Baldwin Locomotive Works an eight-wheel locomotive.

The Raleigh & Augusta Air Line has just received from the Baldwin Locomotive Works three 8-wheel passenger engines, and has received nearly a dozen within the past 12 months. The road is also building in its shops at Raleigh three new passenger cars.

The Philadelphia & Reading has placed an order for ten passenger locomotives with the Baldwin Locomotive Works.

Car Notes.

The Richmond & Danville has let a contract for building 666 box cars to the South Baltimore Car Works, and a contract for 300 box cars to the Tredegar Company, of Richmond, Va.

The Louisville & Nashville is asking bids on 1,000 cars, of which 500 will be box and 500 fruit cars.

The United States Rolling Stock Co., of Anniston, Ala., has been awarded a contract for building 700 cars for the Central of Georgia. An order for building 350 coal cars for this road will also soon be let.

The Erie Car Works, Limited, has been awarded a contract for building 500 gondola coal cars for the Valley road of Ohio. It is expected to complete 12 cars a day, when work on them is commenced. The orders which the works now have are sufficient to keep it busy for nearly a year.

The Elliott Car Co., of Gadsden, Ala., is building 38 fruit cars, 18 cabooses and 100 platform cars for the Alabama Great Southern road.

The Philadelphia & Reading has let the contract for building the 65 fruit cars recently mentioned in these columns.

The Harlan & Hollingsworth Co., of Wilmington, Del., last week completed several new passenger cars for the Wilmington & Northern road.

The Reynolds & Henry Construction Co., which is building the Houston, Central Arkansas & Northern Railroad, is asking bids for platform cars and two locomotives.

Bridge Notes.

The Phoenix Bridge Co. has just completed a three span iron bridge across the New River, at River View, W. Va., for the Chesapeake & Ohio. One span is 300 ft. long, one 250 ft. and the other 200 ft. Over 40 new iron bridges of all sizes on the line of the road are being built by the Phoenix Bridge Co., the Edge Moor Bridge Works and the Passaic Rolling Mill.

Cofrode & Saylor, of the Philadelphia Bridge Works, have just completed for the Elmira, Cortland & Northern au

iron viaduct 800 ft. long and 80 ft. high at Brokton, N. Y. The viaduct takes the place of a wooden structure, and is one of the finest structures of the kind in New York.

Bids will be received until March 31, at 233 South Fourth street, Philadelphia, by the City Avenue & Germantown Bridge Co. for erecting the piers and abutments of a bridge across the Schuylkill River at City Avenue, Philadelphia, Pa.

The Baltimore & Ohio has recently rebuilt a new bridge of two 160 ft. spans over the Cheat River at Rowlesburg, W. Va., to replace one damaged last fall.

The Catasauqua & Fogelsville road is rebuilding an iron bridge over the Jordan River, which was originally built in 1857. There will be 11 spans of cast and wrought iron, of 100 ft. each, and resting on two abutments, and 10 cast-iron towers, each about 55 ft. high. The total height of the new bridge above water will be 85 ft., and it will rest on the abutments and wrought-iron towers, and will be of wrought and steel.

The Mt. Vernon Bridge Co., of Mt. Vernon, Ohio, last week finished a new iron truss bridge over Stone's River, at Stewart's Ferry, near Nashville, Tenn.

The Pennsylvania Company is raising the draw and approaches of the Maumee River bridge of the Northwest Ohio road at Toledo.

The Florida Railway & Navigation Co. is building a combination bridge over the Suwanee River at Ellaville, Fla. The bridge contains two spans of 153 ft. each.

A new iron bridge is to be built at Montezuma, Ga.

The Berlin Bridge Co. has been awarded the contract for building a bridge at Southport, Conn., at a cost of \$14,000.

The commissioners of Chester County, S. C., are building an iron bridge over the creek at Rocky Mount.

The Oregon Railway & Navigation Co. is building a new 5-span steel bridge across the Snake River at Riparia, Ore., and the first span is now in position.

The New York, Pennsylvania & Ohio is finishing a double track fixed bridge across the Mahoning River at Leavittsburg, O. The bridge is 160 ft. long. Early this year the company completed a double track drawbridge at Cleveland, O. The distance between the centre and pins is 220 ft.

The Georgia, Southern & Florida asks proposals for erecting two iron bridges over the Alapaha and Suwanee rivers in Florida. Each bridge will have a span of 150 ft. W. H. Wells, Macon, Ga., is Chief Engineer.

Iron and Steel.

The new steel plant of the Phoenix Iron Co., at Phoenixville, Pa., is now successfully making steel. The machinery and furnaces were designed by F. Heron, Mechanical Engineer of the company, and they have already been described. The new plant consists of four departments—the gas-producing, boiler and pump, steel melting and blooming mill, Mackintosh, Hemphill & Co., Limited, the Scaife Foundry Co., Robinson, Rea & Co., Velt & McDonald, and the Swindell Construction Co., of Pittsburgh, and Morgan Engineering Co., of Alliance, O., made the greater portion of the new plant.

C. H. Emerson has been appointed receiver of the Findlay Iron & Steel Co., of Findlay, O. The liabilities are estimated at \$30,000.

The Pullman Iron & Steel Co. has applied for a receiver. It is now in debt to the amount of \$300,000, of which \$180,000 is owing to the Pullman Palace Car Co., which kept the Iron & Steel Co. running when it was in an insolvent condition. The assets of the company are about \$280,000, consisting mainly of the rolling mill plant at Pullman.

The new blast furnace of the Carrie Furnace Co. at Keating station, on the Baltimore & Ohio Railroad, is nearing completion, and will probably be finished in a few weeks.

A. T. Shoemaker, Duncan building, New York, has been appointed representative of the North Chicago Rolling Mill Co., the Joliet Steel Co. and the Union Steel Co., for the sale of steel rails, etc.

George H. Wrightman, formerly Secretary of the Hartman Steel Co., Limited, has been appointed Northeastern Agent for Carnegie, Phipps & Co., Limited, with headquarters at No. 3 Mason building, Boston.

The Fuel Gas & Electrical Engineering Co. will probably build a foundry and machine shop at Wilmerding, Pa. on the Pennsylvania road.

Among the contracts awarded recently by the Navy Department were the following to Philadelphia firms: Joseph J. White, drilling machines, \$875; Bement, Miles & Co., planing, punching, straightening, bending, countersinking and drilling machines, \$16,020.

The rolling mills at Naomi and Gibraltar, Pa., and the Keystone Rolling Mill at Reading, Pa., have closed down on account of the failure of the Reading Iron Works.

The partnership between W. R. Hart and George T. Barns, under the firm name of Wm. R. Hart & Co., of Philadelphia, has been terminated, but Mr. Hart will continue the business under the same title as before, while Mr. Barns will have his office at 312 Walnut street, and do business under the firm name of George T. Barns & Co.

The Denver & Rio Grande Western has placed with the North Chicago Rolling Mill an order for the first lot of heavy steel rails for use in widening the gauge of the road.

Mr. Thomas Davis, until recently with the Newport Iron & Steel Co., of Newport, Ky., is now Rolling Mill Manager of the Londonderry Iron Co., Limited, of Londonderry, N. S.

The government foundry at Washington is so busy that the construction of the main shafts for the new cruisers "Concord" and "Bennington" has been assigned to the Midvale Steel Co., and that firm are also turning out the steel forging for 12 new 6-in. ordnance rifles.

Manufacturing and Business.

Greenlee Bros. & Co., of Chicago, Ill., manufacturers of wood-working machinery, have supplied the special machines to the new Centropolis Car & Machine Works, of Kansas City, Mo.; the Kansas City Car & Wheel Works, of Birmingham, Mo.; and the Minnesota Car Co., of Duluth, Minn. The firm has also shipped its hollow chisel car mortising machine to the Government Railway, of New South Wales, and have recently shipped large quantities of machinery to the same country.

Ryan & McDonald, Waterloo, N. Y., report heavy sales of construction cars to railroad contractors in February, mostly to Southern states. They report good business through February, with increase in orders so far into March. They manufacture all kinds of contractors' implements.

The Long & Allstatter Co., of Hamilton, O., is building a steam driven machine for punching holes in splice bars, etc., that will punch six holes at a time. The company is also building a multiple punching and welding machine.

N. S. Sherman, of Jackson, Tenn., will soon erect a machine shop and foundry and will purchase the following tools: one 32 x 12 ft. and one 20 x 8 ft. engine lathe, one planer, one 26 in. drill press, chucks, etc., to equip the ops.

The Standard Railway Signal Co. has been organized at Columbus, O., with J. B. McDonald as President, to manufacture the electric signal of A. Z. Boda. The capital stock of the company is \$10,000.

Alfred Box & Co., of Philadelphia, report among recent orders a large radial drill to the Union Bridge Co., which makes 22 drills supplied to this company within the last three years. Also an order for six radial drills for the Hilton Bridge Co., of Albany, N. Y.

The Locomotive Steam Muffler Co. has opened an office in the Commercial building, St. Louis. B. F. Hobart is President of the company, M. J. Lorraine is Manager, and Ira C. Hubbell is Vice-President.

The Deoxidized Metal Co., of Bridgeport, Conn., are about to erect an additional building in that city.

The Gates Iron Works, Chicago, Ill., have recently furnished for Carnegie, Phipps & Co. a rock breaker weighing 45 tons, and is probably the largest rock and ore breaker ever built. It will be used at the Edgar Thomson Steel Works for breaking flux for the furnaces. The Cambria Iron Co., of Johnstown, Pa., and the Birmingham Mining & Milling Co., of Birmingham, Ala., are also using this breaker for the same purpose.

The Pratt & Whitney Co., of Hartford, Conn., has just completed the first Hotchkiss gun made in this country. It is the smallest caliber, 37 millimetre, carrying a 1-lb. shot or shell. It is mounted on a tripod, there being five barrels revolved by a hand-crank, and capable of firing 20 shots a minute. The heavier caliber guns of this pattern, which the Pratt & Whitney Co. is building, are in an advanced state of construction.

The Ingersoll-Sergeant Rock Drill Co., of New York, has succeeded the Ingersoll and Sergeant Rock Drill companies, and it will continue the manufacture and sale of the machinery so well known under the names "Ingersoll" and "Sergeant," with many improvements and additions, which have been effected through the consolidation of interests. The company manufactures the following machines, among others: The Ingersoll stone channeling machine, the Ingersoll tappet and eclipse drill, the Sergeant drill, and the Ingersoll-Sergeant air compressor. The Ingersoll-Sergeant air compressor is an improved pattern of the old "Ingersoll" compressor. Its special features are an improved form of air cylinder, an automatic air regulator, and new swivel cross-head, besides several other improvements in the details of construction.

On and after April 1 next, the general offices of the Eames Vacuum Brake Co. will be removed from Boston to No. 115 Broadway, New York City.

The Rail Market.

Steel Rails.—Southern roads have placed orders with Eastern mills for nearly 30,000 tons of rails, and a Pittsburgh mill has received an order for 10,000 tons. No other large order is reported from the West. The Board of Control reports sales to March 1 of 590,850 tons, the allotment being 790,850 tons. The shipments up to March 1 by the rail mills were 142,787 tons. An arrangement is said to have been made between the North Chicago Rolling Mill Co., the Joliet Steel Co. and the Union Steel Co., which will amount to a virtual consolidation, and that the capital stock will be placed at \$25,000,000.

Old Rails.—The market is dull and quotations are \$23@ \$23.50.

Rail Fastenings.—Quotations: Spikes, \$2, delivered, and angle bars, \$1.75@ \$1.80.

The Cairo Bridge.

The following is an extract from the advance sheets of the annual report of the Illinois Central: "The work on the bridge at Cairo has progressed with remarkable rapidity and in the most satisfactory manner. All of the foundations of the main structure, including the masonry of two shore abutments and ten of the eleven piers are completed, and the two principal spans erected. For the advances to the Chicago, St. Louis & New Orleans Railroad Co. on this account, the notes of that company are held to the amount of \$1,630,573.40. The expenditures on the work in Illinois amount to \$59,292.26. The bridge, including the approaches, is under contract to be finished in November, 1889, at a further cost of \$856,778."

The Corinth Canal.

Work on the Corinth canal is being vigorously prosecuted. Still it is not likely that the canal will be available for traffic before 1890. It may be interesting to repeat here that the construction of the canal was proposed at a geographical congress, held at Venice in 1881. The route to be adopted being that which Emperor Nero had in view 1,800 years ago. The total length will be 4 miles and the depth 26 ft. 8 in., making the material to be excavated somewhere in the neighborhood of 11,000,000 cu. yds. It is estimated that vessels will be able to pass through at a speed of 6 miles per hour. Work was commenced in 1883, and the failure to complete the work by 1888 is ascribed, in a great measure, to the circumstance that it was necessary, because of sandy stretches, to put in masonry walls for a distance of nearly 2 miles.

THE SCRAP HEAP.

New Stations and Shops.

The Louisville, St. Louis & Texas last week purchased four acres of ground in the central portion of Henderson, Ky., and the company will at once erect there depot and freight buildings. Henderson has offered the company \$30,000 and a site to erect the machine shops there, and Owensboro and Cloverport, Ky., have also made similar offers.

A handsome new depot costing \$5,000 is to be built at Fair Haven, Vt., by the Delaware & Hudson Canal Co., to replace one burned not long ago.

The Nashville, Chattanooga & St. Louis has let the contract for the foundation of the new shops at Nashville, Tenn., to Thomas Broderick, of that place, who has already begun work. The shops will cost about \$250,000, and will be ready for occupancy by Fall.

Baltimore & Ohio Employees' Relief Association.

The eighth annual report of this organization is received. The payments of benefits, etc., during the year ending Sept. 30 last amounted to \$358,983. There were 78 deaths from accidents and 139 deaths from other causes. The total membership at the end of the year was 20,267, there having been a considerable decrease on account of the transfer of the sleeping car and telegraph departments of the road to other corporations. Many employees leaving the service retained their membership under the natural death feature, however. Of applicants for employment on the road during the past year 415, or 3.6 per cent., were rejected by the medical examiners; 1.5 per cent. of those examined for sight, hearing and color sense were rejected. Prophylactic medicine to the extent of 13,600 bottles has been distributed.

The charter of the association was repealed by the Marv-

land Legislature at its last session. In compliance with the wishes of the members the railroad company has decided to continue the association, and a plan is now under consideration. During the past year \$23,438 has been paid in pensions. This department is sustained by the railroad company exclusively. The savings fund and building feature has 706 borrowers and outstanding loans amounting to \$332,384. Applications for loans largely exceed the sum available.

A New York, Providence & Boston Car.

At the Auburn car shops the New York, Providence & Boston has under construction a passenger car from designs by the Master Mechanic, which will combine the features of the round roof and the monitor top. The car will be 53 ft. 5½ in. over all, and 9 ft. 7½ in. wide; the monitor roof will be 13 ft. 10 in. above rail level and the interior swell of the elliptical roof will be an antique oak panel and will be finished between the rafters in basket work in quartered oak. The car will have 17 windows on each side and two in each end, each 26 by 34 in. Not a batten is used on the car, even the corner posts being grooved to receive the boarding.

The roof is, perhaps, the most remarkable feature of the car. The carlines are of iron, 2 by ½ in. and in form are exactly half of an ellipse. There are 18 of them and each has a crow-foot turned out on either end, which is secured through the plates by two bolts. When the car is finished the carline will be concealed by an ornamental wooden covering. At the highest point of the ellipse the slightly bowed rafters of the wide monitor roof are attached, the difference in their curvature affording space for the ventilating windows. The car will be heated by steam and lighted by gas. Near the steps on each side and at each end of the car are openings about 2 by 6 in., arranged to draw in fresh air and exclude the dust, and these connect with a duct extending about 10 ft. down the car near the floor, from which, through a small slit, fresh air will be forced into the car when it is in motion.

The car will be carried on two four-wheeled trucks with 38-in. steel wheels.

British Shipbuilding in 1888.

United States Consul Jones, of Cardiff, reports more activity in British shipbuilding yards than any year since 1883, when 1,250,000 tons were launched, after which the quantity declined until 1886; when only 480,000 tons were launched. There was a slight improvement during 1887, and last year 906,131 tons were launched, an increase of 56.6 per cent. on the production of 1887; 806,706 tons of this shipping was of steel and only 3,358 wood or composite, leaving 96,067 tons of iron shipping. The increase in the use of steel is seen to have been very great; 1887 was the first year in which steel tonnage exceeded iron, 58.9 per cent. of the shipping built of metal having been of steel; last year 89.4 per cent. was of steel, and Consul Jones calls attention to the advantages steel making in England receives from this demand. Vessels built on foreign and colonial account aggregated 166,825 tons, and if £18 per ton is taken as the average cost per ton, the British shipbuilders must have received about \$14,500,000 from these sources, while their total receipts must have been near \$50,000,000. Many of the ships built during the "boom" of 1882, and 1883 were of inferior design and workmanship, so that with the older vessels the tonnage of England and her colonies fell, according to a table published in *Industries* last fall, in the three years from 1885 to 1887 from 11,185,692 to 10,561,595 tons, or at the rate of 5.4 per cent.; in fact the tonnage of the whole world decreased by 3.4 per cent. during the same time, and sea freights are now on a very remunerative basis. This decrease of about one million tons in the world's registered shipping is apparently to made good, as Consul Jones reports 445 merchant vessels, representing 811,466 tons, in course of construction in the various yards of the United Kingdom, and thinks it possible the tonnage constructed this year may exceed that constructed in 1883.

Natural Gas in Ohio in 1888.

A late number of the *American Manufacturer* has a careful review of the natural gas situation in Ohio, by Prof. Edward Orton, the State Geologist, who says in effect, that no important discoveries have been made in Ohio during the year, though a great deal of drilling has been going forward, and the productive districts remain as at the end of 1887, four in number, viz., the Berea grit, the Ohio shale, the Clinton limestone and the Trenton limestone. The last-named stratum, which is both a gas and oil-bearing rock in Northern Ohio and Central Indiana, is, excepting possibly the Bradford sand, the most important single source of petroleum and gas on this continent. The oil is still ranked as inferior, on account of the present difficulty of refining it, but there is no drawback to the gas, as is apparent from the following analyses, made for the United States Geological Survey.

	Findlay.	Postoria.	St. Mary's.
Hydrogen.....	1.64	1.89	1.74
Marsh gas.....	93.35	92.81	93.85
Olefiant gas.....	.35	.20	.20
Carbonic oxide.....	.41	.55	.44
Carbonic acid.....	.25	.20	.25
Oxygen.....	.39	.35	.35
Nitrogen.....	3.41	3.82	2.98
Sulphureted hydrogen.....	.20	.15	.21
	100.00	100.00	100.00

The small fraction, ¼ of 1 per cent., of sulphureted hydrogen, is held to be decidedly advantageous, as it affords a certain means of detecting leaks.

No place within the natural gas belt has derived greater advantages from this fuel supply than Findlay, where in November, 1884, it was first found that the Trenton limestone, at some places at least, contained stores of high pressure gas. Since January, 1886, the population of the town has increased from 6,000 to 30,000. Although there are rolling mills, chain works, machine and edge-tool shops, etc., the principal industry is glass, 155 pots being used by the 10 firms engaged in making window glass, fine flint ware and bottles.

This growth has been built up in Findlay, as in other towns, by giving free, or nearly free, gas to manufacturers, a gift which in some instances has been supplemented by land and contributions to capital, either from the town or parties interested in real estate. Under these circumstances, the question of the continuance of the supply is a vital one. Professor Orton has contended that the supply is a stored one, and notwithstanding the reasonableness of the theory, in view of the exhaustion of all deposits of liquid hydrocarbons, the gas has been used most profusely for the rough work of foundries, rolling mills, brick and tile works, lime burning and the like, until a short time since Findlay found itself short of gas. A new well was drilled in, and on being shot responded with a pressure in the open casing of from 38 to 40 lbs., equivalent to a yield of about 30,000,000 cu. ft. per day. The famous Karg well, which has been the main reliance of the town for the past two years, was estimated to discharge 12,000,000 cu. ft.

This shortage of gas has led to an investigation from which

the professor concludes that none of the large wells in the field have flowed three years, practically unrestrained, without giving unmistakable signs of nearing their limit. In some cases oil invades them, in others, salt water. The smaller wells appear in some instances to have a longer lease of life than the great wells. In some of the town wells the original rock pressure has been reduced by about three-eighths, but in others it is claimed it is fully maintained, only more time is required for gathering. The area exhausted by a vigorous well is not yet determined, but it is thought that the central portion of Findlay is partially drained of its original supply. As the city has pledged itself to furnish many million feet of gas each day, great energy and sagacity will be required to maintain in full vigor the splendid industries now established and insure the continued prosperity of the town.

What is predicted of the Ohio Trenton limestone gas field may probably be asserted as to the 2,000 square miles of the field in Indiana, though, if wells yielding 30,000,000 cu. ft. of gas per day, equivalent to nearly 1,000 tons of coal, are to be found whenever a shortage occurs, there may be a longer lease of the industrial life of that region than a cursory reading of Professor Orton's article might lead one to infer.

Train Wreckers in Asia.

A St. Petersburg dispatch of March 10 says: A passenger train on the Trans-Caspian Railway was to-day thrown from the track in a tunnel, owing to the removal of rails by train-wreckers. The result of the derailment was frightful, the killed and injured numbering fifty. The band of robbers who tore up the track have been captured.

A Relief Department on the Burlington.

The directors of the Chicago, Burlington & Quincy have decided to establish a voluntary relief department for the benefit of the 30,000 employees of the Burlington and its controlled companies. The system will be similar to that of the Pennsylvania. Employees may become members of the association or not, as they please. The company will pay the expense of operating the benefit department, which is estimated at \$60,000 a year. The death benefits will vary from \$250 to \$1,250.

RAILROAD LAW—NOTES OF DECISIONS.

Powers, Liabilities and Regulation of Railroads.

In Texas the Supreme Court hold that a railroad cannot, by leasing its road, avoid liability to a shipper of freight for loss, caused by fire at a depot, where no authority for such lease is conferred by statute.¹

In Kentucky the Court of Appeals rule that a railroad company which has purchased a road, to the capital stock of which a county has subscribed, is liable to taxation to pay the subscription only on improvements made since the purchase, and not on the value of the road when purchased. The company, having voluntarily paid taxes on the whole value, cannot recover back the part which it need not have paid.²

In Oregon the plaintiff sues the defendant for damages on an alleged breach of a contract whereby the former agreed, in consideration of certain payments, to be made as the work progressed, to construct 52 miles of railroad for the latter. The defendant sets up a counter-claim for the failure to construct the road, and claims damages therefor: (1) For the loss of the use of the road; (2) for the loss of certain freight which it had made "arrangements" to carry over the road; and (3) for the sum it will cost to complete the road in excess of the contract price. The Federal Court orders the last two clauses to be stricken out of the counter-claim; the one, as arising on a collateral contract not within the contemplation of the parties, and the other as being uncertain, and also contingent on the future construction of the road by the defendant.³

In Ohio a contract was entered into between the trustee of an alleged car trust and a railroad company, whereby cars and locomotives were leased by the former to the latter, it agreeing to pay for every car and locomotive delivered an annual rent for the period of 10 years, at the end of which they were to become the property of the railroad. The trustee at the time of the execution of the lease neither owned nor possessed the rolling stock purported to be leased; after the execution of the lease the railroad company furnished to the agent of said trustee the names of subscribers; thereupon such agent made out subscription certificates, which were signed by said trustee as cashier, certifying that the holders would be entitled to so many thousand dollars of car trust certificates when the subscription was paid in full. The money paid in on said subscription certificates was credited thereon and deposited in the bank to the credit of the "equipment account" of the railroad company. When the installments were all paid on the subscription certificates, the railroad company scheduled the rolling stock under said lease, and the trustees certified the car trust certificates and turned them over to the holders thereof *pro rata*, or in full of their subscription if paid up. The railroad company obtained the rolling stock under its own contracts with the car builders. The Federal Circuit Court holds that the car-trust certificates were, in legal effect, mortgage bonds, and as such inferior in point of lien upon such rolling stock, to a prior mortgage with an "after-acquired property" clause.⁴

In Michigan the plaintiff sued a railroad for wages. He testified that before its station agent was appointed he was told by its civil engineer to look after the freight and about the station until the company discharged him; that he delivered goods and collected freight until the agent was appointed; that the agent did not agree to employ him, but said that he would write to the company and have his name put on the pay-roll. Plaintiff remained and worked about the depot. There was no evidence that the superintendent knew that plaintiff was at work, except that he was in the pay car when plaintiff demanded pay. The Supreme Court rule that the plaintiff has no claim against the railroad.⁵

Carriage of Goods and Injuries to Property.

In Kentucky the Court of Appeals rules that a horse having been injured in the presence of defendant's agents in charge of the train, and examined by a surgeon at the instance of defendant, and returned over defendant's road to the place from which he was originally shipped, notice of intention to claim damages, required by the contract of carriage to be given in case of injury, is waived.⁶

In Texas the Supreme Court holds that evidence of a custom of railroads and of defendant to refuse to receive or ship stock unless the shipper will accompany the stock, and tend them himself, and agree to hold the railroad company harmless against ordinary delays, and in case of total loss of stock that the damages shall not be more than their actual cash value, is properly excluded; the custom being unreasonable, and a limitation of the duties and responsibilities imposed upon a carrier by law. It not being shown that there was an officer or agent at the point of shipment or destination, evidence of a custom requiring the shipper to agree as a condition precedent to his right to damages for any loss or injury that he will give notice of claim therefor, before the stock

are removed from the point of shipment or destination, is properly excluded; the custom without such officer or agent being unreasonable.⁷

In Minnesota the Supreme Court rules that the exception, by implication, to the statute imposing upon railroad companies the duty of fencing their tracks, by which such places as are necessary and convenient for the use of the public may be left open, cannot be extended to a siding used merely for the loading of ties, wood and piling purchased by the company, and for the passing of trains, at a point where no depot is maintained, no employee stationed, and where persons desiring to take passage are obliged to flag the trains themselves.⁸

In Missouri the Supreme Court decides that a grant of a right of way to a railroad company, its successors and assigns, containing clauses reciting that the grant was "in consideration of the benefits arising from the location, construction and operation of the road, and the sum of one dollar," and that "this agreement is made for the location, construction and maintenance of said railroad, and for that purpose only, and this license is to operate in perpetuity, if said railroad company, its successors and assigns, shall continue to operate and maintain their railroad, and to cease with the non-use of the same for such purpose," is not upon the condition subsequent to construct the whole line of road upon the same location as that shown by the survey made and filed by the grantee. The statute under which the grantee organized enacts that, if any railroad company shall not finish its road within 10 years from organization, its powers shall cease, provided that, if a portion thereof be in operation, its existence shall continue to operate such portion, but for no other purpose. Grantee's road was to be between two given points, 16 miles distant. Work was commenced, when, becoming insolvent, three years after the road was located, grantee sold its right of way to another company, which constructed and operated a road over the granted premises, and for a distance of six miles over grantee's location, whence it diverged to another point. As so located, the road was operated within 10 years from the date of the first charter, and until after the second company was consolidated with defendant. The Supreme Court holds that the conditions of the gift were complied with, and the grantor's heirs could not recover as for breach of a condition subsequent.⁹

Injuries to Passengers, Employees and Strangers.

In Texas the Supreme Court decides that there is a rule of law that what would be a reasonable time for a man to alight from a train would not be a reasonable time for an aged lady, that being, in each case, a question for the jury. In this case the plaintiff, who was 70 years old, failed to leave the train on which she was a passenger at the station, and was put off a few hundred yards beyond, between 8 and 9 o'clock at night, in the rain. At the trial she was suffering from a bronchial affection; but the evidence was conflicting as to whether it resulted from exposure or other causes. The Supreme Court hold that to charge that if her sickness was not the result of her being put off, and that it was reasonably certain to have resulted from other causes, defendant is not liable, was erroneous, as throwing the burden of showing that the sickness was not the result of the exposure on defendant, and requiring proof beyond reasonable doubt.¹⁰

In Louisiana, the Supreme Court rule that passengers crossing a railroad track at a station, in order to leave or board a train halted for that purpose, are not held to the exercise of the same care and diligence which are ordinarily exacted from persons crossing tracks, but are authorized to assume that the railroad corporation will so order its trains that they will be safe from harm on the track, which he is thus invited and required to cross in order to secure his passage. But where a person attempts to board the train while moving, and after it has left the station, he no longer acts on the invitation, or stands under the protection of the company, and, while crossing or occupying the track, is bound to use proper care for his own protection.¹¹

In North Carolina the defendant railroad issued round-trip excursion tickets to a point on a connecting line. The excursion train was, by contract between defendant and the connecting line, to be taken over the road of the latter by its engine, and in charge of its employees. The Supreme Court rule that such employees were *pro hac vice* defendant's employees, and defendant was liable for injuries to a passenger caused by their negligence on the connecting line.¹²

In Georgia the Supreme Court rule that a railroad company is not liable for injuries to a passenger sustained in attempting to alight from a moving train which had passed the passenger's destination without stopping.¹³

In Missouri the plaintiff, a section hand in defendant's employ, was directed by the foreman to get off the track on which they were working, to make way for a train. He did so, but called the foreman's attention to some stones left on the track. The latter said, "It is time you were getting them off." Plaintiff understood this as an order, and, when the train was 100 yards away, and rapidly approaching, attempted to remove them, when he was struck by the engine and injured. The Supreme Court ruled that the evidence did not show that the danger was so open and obvious to plaintiff that he ought to have refused to obey the order, and the railroad is liable.¹⁴

In Nebraska the Supreme Court holds that the construction and operation of a railroad without blocking its frogs and switches is not negligence *per se*, of which a court will take judicial notice upon proof of the fact of such construction and operation, and failure to block the frogs and switches only. In an action by an administratrix against a railroad company for damages for the death of her husband, it was alleged in the petition that in constructing its line of railroad the defendant negligently failed to block its switches and frogs, by means of which the deceased, a brakeman employed by defendant in coupling cars stepped his foot between the rails of a switch and became fastened there, by reason of which he was run over by the cars and killed. The Supreme Court rules that the plaintiff could not recover without the evidence of practical men that unprotected frogs and switches are inherently unsafe and dangerous when prudently and carefully worked and managed, and that blocking them materially lessens the danger of their use and management, and that such was generally recognized by those engaged in the construction and operation of railroads in the country or vicinity by the adoption and use of such improvement, or of evidence equivalent.¹⁵

In Dakota, in an action against a railroad company for personal injuries, the evidence showed that plaintiff, a servant of defendant, while riding on one of its trains, and standing on the lowest step of the car platform, was struck by a switch-signal, which stood so near the track that it scraped the sides of the cars in the train. The Supreme Court hold the railroad liable.¹⁶

In Texas the Supreme Court holds that a brakeman who, in attempting to let off a defective brake, is struck by a cattle-guard which, like all the guards along the road, is dangerously near the track, and who knows the defective character of the brake, and that many of the guards were so near as to be dangerous, though he did not know as to the one in question, cannot recover, as he will be held to take the risk incident to the employment.¹⁷

In Dakota the deceased walked from a station platform,

60 ft., to a track on which freight cars were standing, and attempted to cross the track between cars standing only two or three feet apart, while the freight train which killed him was backing in upon such track in full view. Deceased, a man in full possession of his faculties, neither noticed said train nor heeded the cries of two persons who attempted to warn him. The Supreme Court hold that the railroad is not liable, though defendant's train-men failed to exercise ordinary care in the management of the train.¹⁸

In Indiana the Supreme Court rules that where the object of a contract between two railroad companies was that defendant should secure a way across plaintiff's road, and maintain the crossing safe for the use of both parties,—whatever was reasonably necessary to secure this object was implied; and it was competent for the parties to give effect to the contract by establishing a code of signals, a failure to comply with which would render the defendant liable, without any stipulation as to such liability. Where a railroad train had the right of way at a crossing, there was no negligence in the employees controlling the train, upon seeing defendant's cars approaching the crossing, assuming that they would stop in obedience to the obligation of their contract.¹⁹

- ¹ Int. & G. N. R. Co. v. Moody, 9 S. W. Rep., 465.
- ² L. & N. R. Co. v. Hopkins Co., 9 S. W. Rep., 497.
- ³ Hunt v. O. Pac. R. Co., 36 Fed. Rep., 481.
- ⁴ Central Trust Co. v. Ohio Cent. R. Co., 36 Fed. Rep., 520.
- ⁵ Willis v. T. A. & N. M. R. Co., 40 N. W. Rep., 353.
- ⁶ Owen v. L. & N. R. Co., 9 S. W. Rep., 693.
- ⁷ Mo. Pac. R. Co. v. Fagan, 9 S. W. Rep., 613.
- ⁸ Hunt v. St. P., M. & M. R. Co., 40 N. W. Rep., 613.
- ⁹ Morrell v. W. St. L. & P. R. Co., 9 S. W. Rep., 637.
- ¹⁰ St. L., A. & T. H. R. Co. v. Burns, 9 S. W. Rep., 467.
- ¹¹ Weeks v. N. O. S. F. & L. R. Co., 5 South Rep., 72.
- ¹² Washington v. R. & G. R. Co., 7 S. E. Rep., 789.
- ¹³ Watson v. Ga. Pac. R. Co., 7 S. E. Rep., 854.
- ¹⁴ Stephens v. H. & St. J. R. Co., 9 S. W. Rep., 589.
- ¹⁵ Mo. Pac. R. Co. v. Lewis, 40 N. W. Rep., 401.
- ¹⁶ Boss v. N. P. R. Co., 40 N. W. Rep., 590.
- ¹⁷ Mo. Pac. R. Co. v. Somers, 9 S. W. Rep., 741.
- ¹⁸ Bertelson v. C. M. & St. P. R. Co., 40 N. W. Rep., 531.
- ¹⁹ N. Y. C. & St. L. R. Co. v. S. R. & I. R. Co., 15 West Rep. 548.

General Railroad News.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

- Boston & Albany, quarterly, 2 per cent., payable March 30.
- Buffalo & Southwestern, 5 per cent. on the preferred stock, payable March 7.
- Missouri Pacific, quarterly, 1 per cent., payable April 15.
- New York Central & Hudson River, quarterly, 1 per cent., payable April 15.
- New York & Harlem, quarterly, 2 per cent. on preferred and common stock, payable April 1.

Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

- Atchison, Topeka & Santa Fe, annual meeting, Topeka, Kan., May 9.
- Cairo, Vincennes & Chicago, special meeting, Cairo, Ill., April 25.
- Chesapeake, Ohio & Southwestern, annual meeting, Memphis, Tenn., April 1.
- Chicago, St. Louis & New Orleans, annual meeting, Memphis, Tenn., March 29.
- Chicago, St. Louis & Pittsburgh, annual meeting, Union Depot, Indianapolis, March 20.
- Cleveland, Chagrin Falls & Northern, special meeting, Cleveland, O., March 27.
- Evansville & Richmond, annual meeting, Washington, Ind., March 18.
- Kentucky Central, annual meeting, Covington, Ky., March 19.
- Mississippi & Tennessee River, annual meeting, Memphis, Tenn., March 29.
- New York, Ontario & Western, special meeting, 16 Exchange place, New York, April 3.
- New York Central & Hudson River, annual meeting, New York City, April 17.
- Tennessee Coal, Iron & Railroad Co., annual meeting, Tracy City, Tenn., April 1.

Railroad and Technical Conventions.

Meetings and conventions of railroad associations and technical societies will be held as follows:

- The National Association of General Passenger & Ticket Agents will hold its thirty-fourth annual meeting at the Hotel Brunswick in New York, March 19.
- The Train Dispatchers' Association will hold its second annual convention in Indianapolis, Ind., June 12. E. J. Peabody, 237 Franklin street, Chicago, is Secretary.
- The American Railway Master Mechanics' Association will hold its next annual convention at Niagara Falls, beginning Tuesday, June 18, with headquarters at the International Hotel. All who wish to secure rooms should apply to Mr. A. H. Gluck, Manager, International Hotel, Niagara Falls, N. Y.
- The National Association of Railway Surgeons holds its annual convention in St. Louis, Mo., May 2, 1889.
- The New England Railroad Club meets at its rooms in the Boston & Albany passenger station, Boston, on the second Wednesday of each month.
- The Western Railway Club holds regular meetings on the third Tuesday in each month at its rooms in the Phenix Building, Jackson street, Chicago, at 2 p. m.
- The New York Railroad Club meets at its rooms, 113 Liberty street, New York City, at 7:30 p. m., on the third Thursday in each month.
- The Central Railway Club meets at the Tift House, Buffalo, the fourth Wednesday of January, March, May, August and October.
- The American Society of Civil Engineers holds its regular meetings on the first and third Wednesday in each month at the House of the Society, 127 East Twenty-third street New York.
- The Boston Society of Civil Engineers holds its regular meetings at its rooms in the Boston & Albany station, Boston, at 7:30 p. m. on the third Wednesday in each month.
- The Western Society of Engineers holds its regular meetings at its hall, No. 67 Washington street, Chicago, at 7:30 p. m., on the first Tuesday in each month.
- The Engineers' Club of St. Louis holds regular meetings in St. Louis on the first and third Wednesdays in each month.
- The Engineers' Club of Philadelphia holds regular meetings at the house of the Club, 1,123 Gerard street, Philadelphia.
- The Engineers' Society of Western Pennsylvania holds regular meetings on the third Tuesday in each month, at 7:30 p. m. at its rooms in the Penn Building, Pittsburgh, Pa.

The Engineers' Club of Kansas City meets at Kansas City, Mo., on the first Monday in each month.

The Civil Engineers' Society of St. Paul meets at St. Paul, Minn., on the first Monday in each month.

The Montana Society of Civil Engineers meets at Helena, Mont., at 7.30 p. m. on the third Saturday in each month.

The Civil Engineers' Club of Kansas holds regular meetings on the first Wednesday in each month at Wichita, Kan.

American Society of Civil Engineers.

The Committee on the proposed European trip is embarrassed by the fact that replies to the last circular have not been received from many who had previously expressed an intention to join the party. It is absolutely necessary to conclude the steamship arrangements immediately. The rate stated in previous circular can still be secured, provided application is made at once, and the rooms secured by deposit of the money. That rate is \$110 for the round trip, New York to Liverpool, and return. This offer is available for members and those accompanying them. A special offer has been made by the Inman Line as follows: To leave New York by their large steamer "City of New York" on May 29, at rate of \$125 to Liverpool and return; the return ticket to be limited to Aug. 15, or if used after Aug. 15 an extra charge of \$10 to be paid by each person before embarking. This is for inside rooms on main deck of steamer, each room to be occupied by two persons. Should any persons desire better accommodations on the "City of New York," a discount of \$19 from the regular tariff rate will be made on each round trip ticket. This offer is made on the basis of its immediate acceptance by at least 40 persons.

Civil Engineers' Society of St. Paul.

A regular meeting was held March 4. The committee upon interchange of members between engineering societies reported in favor of a plan for this purpose, provided that all societies united in it, and the committee was continued, with instructions to correspond with other societies on the subject. The committee on bridge legislation made a report, and the bill prepared by the Engineers' Club of Kansas City, now before the Missouri Legislature, was read. Discussion was had upon the desirability of legislation for this purpose, and as to what it should be. Mr. Horton considered that the attempt to regulate the construction of bridges by law would be felt in the erection of structures unnecessarily strong for many country towns, and many such places would be unable to build bridges on account of greatly increased cost. In his opinion the tax payers should be considered. Bridges erected by towns at present are ordinarily ample to carry the usual loads brought upon them, and the percentage of accidents is very small. Mr. Loweth remarked that while both railroad and highway bridges might be improved by legal inspection by skilled engineers, yet this is not a good time to call for more legislation controlling the action of railroad companies. Some good results, however, might be expected from having the plans and strain-sheets of all bridges filed at the capitol of the state. Mr. Osborn thought that legislation was not needed to force railroads to build safe bridges, as it is so greatly for the interest of each company to see that its structures are safe. The matter was further discussed by Messrs. Rockwell, Münster and Mason. The general feeling of the speakers was rather against legislative enactments, but in favor of compelling plans and strain-sheets to be filed so as to be accessible to the public.

Engineers' Club of Cincinnati.

The regular meeting of the club was held March 6, with 26 members present. One new member was admitted and applications received from four. The date of meeting was changed from the first Wednesday to the fourth Thursday in each month. Several changes in the by-laws were adopted, providing for a question box, the formal introduction of new members and some changes in the regulation of annual dues. Dr. Carl Schenck read an interesting paper on the subject of "Methods and Results of Accurate Measurements of Base Lines in General," describing the manner of, and apparatus used in, making them, and referred more particularly to the measurement of the base line established by the United States Coast Survey near Louisville, Ky., in 1879. The meeting was supplemented by a lunch provided by the Executive Board.

Engineers' Club of Kansas City.

A regular meeting was held March 4, President O. B. Guna in the chair, eleven members and three visitors present. Messrs. John E. Thomas, Waterman Stone, J. B. Chapman, F. E. Sickles, E. A. Harper, R. H. Elliott and L. B. Root were elected members. The Committee on Bridge Reform reported progress. Mr. Chanute, Prof. J. B. Johnson and Mr. Breithaupt had gone to Jefferson City, Mo., to represent the St. Louis and Kansas City societies. The bill presented has been revised and returned to the sub-committee, to whom it was referred by the Legislature. The counties are dissatisfied with the present law concerning the letting of county bridges, and will be glad to have a better one, but there is much jealousy of any interference with the authority of the counties, and the bill required modification in that particular. Railroad bridges are already provided for by the general railroad law of Missouri.

Mr. C. E. Taylor read a paper on Strengthening Iron Bridges, which was discussed by Mr. Goldmark.

The following is the programme for other meetings:

April 1, Proposed Sewerage for O. K. Creek District, W. Kiersted and A. J. Mason; May 6, Foundation for the Linnfjord Bridge, Otto F. Sonne; June 3, The Nature of Pollution with Reference to Sewerage, Kenneth Allen.

Engineers' Club of Philadelphia.

A regular business meeting was held Mar. 2, 1889, President William Sellers in the chair; forty members present. The resignations from active membership of Messrs. H. N. Sims, J. C. des Granges and Wm. F. Mencke were read and accepted. The Secretary presented a communication from Mr. John Trautwine, Jr., now in England, covering interesting descriptions of his journey thither, of the "City of New York," in which he sailed, the Grand Junction Water-Works and the new Tower Bridge, London, with illustrations.

Some remarks on points of English, as compared with American, engineering were made by Messrs. T. Carpenter Smith and Frederic Graff.

The Secretary presented, for Mr. Samuel Tobias Wagner, a set of conventional signs for bridge rivets, which Mr. Wagner refers to as being generally adopted as a standard and having special merits. There was some discussion by Mr. Henry B. Seaman, wherein he pointed out what he considered some of the defects of this particular system.

Minneapolis Society of Civil Engineers.

At the meeting of March 6 Mr. G. E. Cray read a paper on "Permanent Improvement of Highways," which was discussed at considerable length.

New York Railroad Club.

The next regular meeting of the New York Railroad Club will be held at its rooms, 113 Liberty street, New York City, on Thursday, March 21, at 7.30 p. m. The subject before the meeting will be "The Use of Iron in Freight Car Construction," and a paper will be read by Mr. G. W. Ettenger, of the Iron Car Company, on the tubular form of iron freight car framing.

Western Railway Club.

The next meeting will be held at the Phenix Building, Chicago, March 19, at 2 o'clock p. m. The topics considered will be "Draw-bar Rigging," to be introduced by Mr. C. A. Schroyer, of the Chicago & Northwestern, and "Axles for 60,000 Pound Cars," continuation of last month's discussion.

PERSONAL.

—Mr. Thomas G. Bassett, one of the oldest employes of the New York Central & Hudson River, and Freight Agent at the Thirty-second street station in New York, died March 11.

—Inter-state Commerce Commissioner Aldace F. Walker has accepted the chairmanship of the Inter-state Commerce Railway Association, and will assume the duties of his position about April 1.

—Mr. George E. Blaine, Superintendent of the New York, Mahoning & Western, has resigned that position, and is now connected with Richard Klegg & Co., contractors, of Ottawa, Ohio, who are to build a long new road in Mexico.

—Mr. David Mackenzie has resigned his position as General Superintendent of the Mexican Central, which he has held for five years. He was also, for about a year, Assistant Superintendent of the same road, and was for over two years Assistant General Passenger Agent of the Central Vermont.

—Mr. P. C. Stohr, General Eastern Agent of the Chicago, St. Paul & Kansas City, has been appointed General Freight Agent of the road, and will have charge of the freight business in place of J. T. Hanley, Traffic Manager, resigned. Mr. Stohr has been General Eastern Agent of the road since the office was established.

—Mr. Emmons Blaine has resigned his position as General Freight and Passenger Agent of the Chicago, Santa Fe & California road, and it is understood is to be Vice-President of the West Virginia Central & Pittsburgh road. Mr. Blaine has held the position he has just resigned three years, and was previously Division Freight Agent of the Chicago & Northwestern.

—John Ericsson died at his home in New York, March 8, 1889, aged nearly 85 years. His name will long be heard with reverence and gratitude for his inestimable services to the Union and to humanity. Great engineers, like poets, are born to their trade, and Captain Ericsson was a shining example of the natural engineer. Born on July 21, 1803, in Sweden, he made some notable inventions when a mere child, and thus gave promise of his future achievements. He entered the Swedish army as a cadet at the age of twelve, and was employed in mechanical and civil engineering work. When about twenty-two years old Captain Ericsson resigned his commission and went to London, where he remained several years, during which time he designed and introduced a number of machines, the most important of which were a system of artificial draft for steam boilers, a locomotive, "The Novelty," for the competitive test on the Liverpool & Manchester Railway, in the fall of 1829; a steam fire engine in the same year, the application of the link-motion to two locomotives about a year later and a screw propeller in 1837.

Captain Ericsson's mechanical work in this country is best known by the "Princeton," the caloric engine and the "Monitor." The U. S. man-of-war "Princeton," designed by Ericsson in 1841, was the first steamship ever constructed having the propelling device completely under water. The caloric engine was fitted in the steamer "Ericsson" in 1852, and proved very economical, but was not permanently successful. The portable caloric engine designed by Captain Ericsson has been largely introduced for purposes where light power was required. The story of the "Monitor," which revolutionized the navies of the world, is well known. A torpedo-boat, with a submarine gun, for attacking iron-clad vessels in unprotected portions of their hulls, was also constructed by Captain Ericsson.

During the later years of his life, Ericsson's efforts have been devoted largely to perfecting his caloric engine, and the researches on the practical application of the sun's heat to driving solar engines.

In this brief sketch, only the most salient features in the life of this remarkable inventor have been noticed. A highly educated man, an excellent draughtsman, endowed with unusual health and energy, and possessing during the later years of his life ample means for pursuing his researches, Capt. Ericsson was a most prolific inventor in nearly every branch of mechanics; and an account of his inventions and researches, published in 1876, and describing his contributions to the Centennial Exhibition, filled 600 quarto pages. The funeral ceremonies of this distinguished man were held in Trinity Church, on March 10, the pall-bearers representing some of the best known names in the mechanical and professional world.

Delegations from various societies attended, including one from the American Society of Civil Engineers. The body was temporarily placed in a receiving vault, and will be eventually sent to Sweden.

ELECTIONS AND APPOINTMENTS.

Atlanta & Charlotte Air-Line.—At the annual election held in New York, March 13, the following were elected directors for the year: Hiram W. Sibley, Eugene Kelly, Richard Irvin, B. R. McAuliffe, Skipwith Wilmer, Charles M. Fry, R. H. Rochester, Joseph Bryan, J. Henry Williams, James H. Young, P. P. Dickinson, and J. W. Brown. At the meeting of the new Board, Hiram W. Sibley was unanimously elected President of the company for the twelfth time, but positively declined to serve, and Eugene Kelly was elected in his place.

Battle Creek & Bay City.—On the application of the Farmers' Loan & Trust Co. of New York, W. K. Ackerman, of Chicago, has been appointed Receiver of the Battle Creek & Bay City and St. Louis, Sturgis & Bay City roads.

Belleville, Centralia & Eastern.—The incorporators of this new Illinois company are: David J. Mackey, William Hellman, Samuel Bayard, William D. Ewing, Walter J. Lewis and John E. Inglehart, of Evansville, Ind.; Buford Wilson, of Springfield; Edward Q. Hopkins, of Peoria; and Gustavus A. Koerner, of Belleville. The five first-named incorporators compose the board of directors. D. J. Mackey was elected President and W. J. Lewis Secretary and Treasurer.

Cape Girardeau Southwestern.—D. S. Brown has been elected Vice-President, and E. F. Blomeyer has been appointed General Freight and Passenger Agent in addition to his duties as Assistant Superintendent. The general office is at Cape Girardeau, Mo.

Chesapeake & Ohio.—Mr. J. T. Harahan, Assistant General Manager of the Lake Shore & Michigan Southern, has been elected General Manager of this company, with office in Cincinnati, Ohio.

Chicago, St. Paul & Kansas City.—J. A. Hanley, Traffic Manager, having resigned, the offices of Traffic Manager

and Assistant Traffic Manager have been abolished. P. C. Stohr has been appointed General Freight Agent, with headquarters in Phenix Building, Chicago, Ill.

John Colley has been appointed General Baggage Agent of the road, with office in Passenger Station, corner Polk street and Fifth avenue, Chicago.

Claim Agents' Association of the Eastern, Middle and Southern States.—The association held its annual meeting March 7, at Old Point Comfort, Va. About 30 roads were represented. Frank D. Howell, Freight Claim Agent of the Pennsylvania, was elected President; A. L. Langdon, General Freight Agent of the Cumberland Valley, Vice-President, and F. B. Goodall, of the Pennsylvania, Secretary-Treasurer. The next meeting will be held at the West End Hotel, Long Branch, N. J., on Aug. 1, 1889.

Connecticut Railroad Commission.—Gov. Bulkeley has reappointed George M. Woodruff, of Litchfield, and Willam H. Hayward, of Colchester, State Railroad Commissioners, each for the term of four years. Mr. Woodruff was first appointed in 1874 by Gov. Charles R. Ingersoll, and has had the longest service of any railroad commissioner in the country.

Delaware & New England.—The incorporators of this New Delaware company are: John S. Wilson, Charlemagne Tower, Jr., Arthur E. Newbold, Henry McCormick, Francis W. Kennedy, Stephen A. Caldwell, John W. Brock, W. W. Gibbs, Arthur Brock, Henry O. Seixas, Joseph F. Sinnott, Charles F. Berwind and Charles E. Morgan.

Durham & Northern.—The following appointments have been made: General Freight and Passenger Agent, F. W. Clark, Portsmouth, Va.; Auditor, J. B. Martin, Raleigh, N. C.; Car Accountant, D. S. Hudgings, Raleigh; Auditor of Tickets, T. H. Wright, Wilmington, N. C. John C. Winder, of Raleigh, is President.

Duluth, Crookston & Northern.—This new Minnesota company has elected the following officers: President, Robert J. Montague; Vice President, John McClean, Secretary, Edmund M. Walsh; and Treasurer, William Anglin.

Geneva & Van Ettenville.—The following are named as incorporators of this New York Company: George M. Diven, Henry S. Redfield, John M. Diven, Eugene Diven, William Falck and Daniel R. Pratt, Elmira, N. Y.; Joseph W. Bishop, Sayre, Pa.; Peter M. Wise and James B. Thomas, Ovid, N. Y.; Joseph S. Lewis, Geneva, N. Y.; George G. Montgomery, Odesa, N. Y.; Nelson Nivison, Burdett, N. Y., and David W. Birge, Hector, N. Y.

Grand Rapids & Indiana.—The old board of directors was re-elected at the annual meeting held last week in Grand Rapids, Mich.

Guelph Junction.—At the recent annual meeting the following officers were elected: President, William Bell; Vice-President, Mayor Gowdy; Secretary and Treasurer, George Murton.

Hutchinson, Oklahoma & Gulf.—The directors of this new Kansas company are as follows: A. L. Williams, Topeka; David B. Hall, Kansas City; Edwin E. Wise, Chicago; Welbur T. Armstrong, Delezn D. Foster, Boston; Wm. T. Phinehart, Pittsburgh, Pa.; James T. Purcell, Boston; J. Franklin Borie, Harrison Skinner, J. C. Boynton, New York; G. A. Wullop, Charles Collins, A. W. Lee, Hutchinson; F. Hubbard Parsons, George L. Rhodes and H. J. Whitcomb, Chicago.

Julian & Rutledge.—The incorporators of this Alabama company noted last week are as follows: J. S. Johnson, E. F. Dyer, F. M. Cody, J. S. Marsh, Thomas W. Shows, J. T. Stephens and Warren T. Shows, all of Rutledge, Ala.

Illinois Central.—At the annual meeting in Chicago, March 13, for the election of five directors, the following were elected: B. F. Ayer, Walter Luttgren, John W. Auchincloss and George Bliss, leaving one vacancy to be filled.

Lake Erie & Western.—Robert T. Brydon has been appointed General Passenger Agent, vice T. N. Lee, resigned to accept service with another company. His headquarters are at Indianapolis.

Louisville Bridge Company.—At the annual meeting held in Louisville, Ky., March 4, the following officers and directors were chosen: C. H. Gibson, President; J. N. McCullough, Thomas D. Messler, James McCreary and James B. Speed. All the old officers were re-elected.

Louisville, New Albany & Chicago.—The annual meeting of the stockholders of the company was held at the New York office, No. 31 Nassau street, March 13. The following directors were elected: John J. Astor, Samuel Sloan, R. G. Rolston, James Roosevelt, William Dowd, Elihu Root, H. H. Cook and Joel B. Erhardt, of New York; George F. Postlethwaite, of London; Robert R. Hitt, C. R. Cummings and John B. Carson, of Illinois; and J. M. Fidler, of Kentucky. The former officers were re-elected: William Dowd, President; John B. Carson, Vice-President and General Manager; and W. H. Lewis, Secretary and Treasurer. The Executive Committee consists of William Dowd, J. J. Astor, Samuel Sloan, R. G. Rolston, Robert R. Hitt and James Roosevelt. The only new members of the board are Joel B. Erhardt, of New York, and George F. Postlethwaite, of London. Henry A. Hathaway has been appointed General Southern Passenger Agent in charge of all the company's business in the South, as well as of that of the Louisville Southern.

Milledgeville & Asylum.—W. W. Lumpkin has been elected President, to succeed S. Barrett, resigned.

Missouri Pacific.—The annual election was held in St. Louis, March 12, and resulted in the selection of the following directors: Jay Gould, Sidney Dillon, Samuel Sloan, Russell Sage, Thomas T. Eckert, George J. Gould, H. G. Marquand, A. L. Hopkins, E. K. Sibley, George J. Forrest, S. C. Greely, Dr. J. P. Munn and S. H. H. Clark. The only change in the directory is the selection of Dr. Nunn in place of R. S. Hayes.

Niagara Falls & Whirlpool.—The following directors were elected last week: D. W. Fenton, S. Fenton, Jr., Brooklyn; Benjamin Fenton, Norris Morey, H. W. Sprague, Alexander White, LeRoy S. Oatman, Buffalo. The following officers were chosen: President, D. W. Fenton; Vice-President, Benjamin Fenton; Treasurer, S. Fenton, Jr.; Secretary, Alexander White; Attorney, Norris Morey.

Paxton & Eastern Illinois.—This company has been chartered in Illinois by Charles Bogardus, Randolph Cruzen, Jonathan P. Medalcott, Samuel L. Day and John H. Moffet, all of Paxton.

Philadelphia, Marlton & Medford.—The stockholders of the company held their annual meeting in Camden, N. J., March 7, and elected the following board of directors: George N. Roberts, Joseph N. Du Barry, Henry D. Welsh, Daniel M. Zimmerman, Edmund E. Read, William C. Houston, Benjamin Cooper, Elwood Evans, Elijah B. Woolston, Crawford Miller, Charles J. Walton, Sr., Joseph Evans and

Joshua S. Wills. The board subsequently organized by the election of George B. Roberts as President, Daniel M. Zimmerman, Secretary, and William Taylor, Treasurer.

Philadelphia & Reading.—Division Superintendent M. F. Bonzano now has charge of the Philadelphia & New York division, which is composed of the North Penn & Bound Brook division and the Germantown & Norristown branch.

San Gabriel Valley Rapid Transit.—The following are the officers of the company: E. F. Spence, President; H. A. Nureh, Secretary; and F. Q. Story, Auditor and Treasurer. The office is at No. 9 Arcadia street, Los Angeles, Cal.

St. Charles & Helena.—W. H. Bradford has been elected President, and John Shinn, Secretary.

St. Louis, Iron Mountain & Southern.—The following directors were elected this week: Jay Gould, George J. Gould, Russell Sage, George W. Allen, L. H. Roots, Samuel Shethar, John T. Terry, Henry Whelan, A. L. Hopkins, Duncan Pamply, R. J. Lockland and S. H. H. Clark. In place of R. S. Hayes, John C. Brown was elected.

South Beach.—Virgil A. Krepps has been chosen Treasurer of the company, with office at 18 Cortlandt street, New York city.

South Carolina.—The annual meeting of the stockholders of the company was held in Charleston, S. C., March 6, and the old Board of Directors was re-elected with the exception of P. R. Pyne, who is succeeded by Thomas Stokes, of New York.

Tacoma & Lake City Navigation Co.—The following are the incorporators of this company: Fremont Campbell, F. C. Ross, C. A. Maubert, James D. Smith, T. R. Jordan and L. T. Root.

Texas & Pacific.—The new Board of Directors have elected these officers: President, John C. Brown; First Vice-President, George J. Gould; Second Vice-President, S. H. H. Clarke; Secretary and Treasurer, C. E. Satterlee. The only change made was the election of Mr. Clarke to fill the vacancy made by the death of H. M. Hoxie.

Tiffin & Tremont.—The officers of this Ohio company are: J. O. Sloan, President; W. E. Cunningham, Secretary and Treasurer; F. S. White, Vice-President. The directors are: J. O. Sloan, F. S. White, W. E. Cunningham, C. O. Tillison and R. P. Hayes. The principal office is at Lakeside, Ohio.

Topeka, Westmoreland & Marysville.—This Kansas company has been incorporated by the following, who are also named as directors: John R. Mulvane, H. C. Line, J. B. Evans and J. W. Pattison, of Topeka; J. W. Fitzgerald, of St. Marys; A. Merritt, of Louisville, and A. Richards and A. B. Pomeroy, of Westmoreland.

Wabash Western.—The following directors were elected this week: O. D. Ashley, T. H. Hubbard, E. T. Wells, Cyrus J. Lawrence, H. K. McHarg, Peter B. Wyckoff, Effingham H. Nichols, James F. Howe and Charles M. Hays. The only change in the board are H. K. McHarg, who succeeds R. A. Elmer, and Charles M. Hays, who is added to the list of directors. The board will meet in New York on March 28 to elect officers.

OLD AND NEW ROADS.

New Companies Organized.—Delaware & New England.—Geneva & Van Ettenville.—Greenville & Southeastern.—Hutchinson, Oklahoma & Gulf.—Milford & Lake Michigan.—Paxton & Eastern Illinois.—Santa Fe Southern.—Tacoma & Lake City Railroad & Navigation Co.—Topeka, Westmoreland & Marysville.

Annapolis & Baltimore Short Line.—Joseph M. Brian, of Pumphrey, Ind., is constructing a short connecting line between this road and the Bay Ridge & Annapolis, at a point about half a mile from Annapolis.

Belleville, Central & Eastern.—This company has been chartered in Illinois with a capital stock of \$100,000 to construct a road from a point at or near Belleville, St. Clair County, through the counties of Clinton, Jefferson and Marion, and into the county of Wayne to a point near Wayne City. The incorporators are officers or directors of the Evansville & Terre Haute, and the new line would, if constructed, furnish the proposed connecting line between the recently acquired Louisville, Evansville & St. Louis, and Illinois & St. Louis, and the Evansville & Terre Haute. The line will be about 60 miles long.

Boston & Albany.—The Senate has passed to a third reading the bill authorizing the road to increase its capital stock by \$10,000,000, by a vote of 28 to 9. This insures its final passage, as it has already passed the House.

Burlington, Cedar Rapids & Northern.—A statement has been recently published in our contemporaries that this road intended to build a line from Rockford to Mason City, Ia., and from Marble Rock to Charles City, but we are informed on the best of authority that the statement referred to is entirely erroneous and has no foundation in fact.

Cape Fear & Yadkin Valley.—The company expects to begin tracklaying early in May on the 81-mile extension from the present terminus at Fayetteville, southeast to Wilmington. About 54 miles of the line is now graded. W. P. Fortune, of Wilmington, N. C., is the contractor for the 31 miles between the Black River and Wilmington. The rest of the line is being constructed by convicts from the North Carolina State Penitentiary. M. T. Mormoyle, of Fayetteville, has the contract for building the piers for the bridge. This work is to be completed by next July. John H. Hanly, of Wilmington, has the contract for the wharf at Wilmington. John S. Allen will construct the pile trestling there, and Thomas Woodruff, of Greensboro, N. C., will build the warehouse on the wharf.

Central Michigan.—A company of this name has been formed in Michigan, and has acquired the constructed road of the Lowell & Hastings, between Lowell and Hastings, Mich., 20 miles. It is proposed to build a road about 350 miles long, from Rogers City, on Lake Huron, southwest to Coldwater, near the southern boundary of the state. It is intended to build through Grayling and Battle Creek, and it is claimed that 60 miles of the road will be completed this year. Nearly \$500,000 in local aid has been secured. The principal traffic will be in lumber and iron ore. J. W. Boynton is President, and J. H. Roberts is Chief Engineer, both at Grand Rapids, Mich.

Chesapeake & Ohio.—C. D. Langhorne, of Richmond, Va., is building for this company 2½ miles of road down the left bank of the New River to Riverview, W. Va. The company has just let a contract for building a four-mile coal branch up Paint Creek, and has made several reconnaissances for other branches to coal lands on Cabin Creek, Piney Creek and other tributary streams.

Chicago & Northwestern.—The company has made surveys for a new line from Montrose to North Evanston, Cook County, Ill., a distance of 7½ miles. Both points are

now on the road, and near Lake Michigan, about 10 miles north of Chicago.

Cincinnati Circular.—An engineer corps is being organized to survey this road, and when that has been completed, it will be definitely decided when the road will be built; as yet nothing very definite has been done, and no contracts have been let. The terminal points will be the villages of Sedamsville and Red Bank, Hamilton County, Ohio, and the route will be through Mill Creek Valley, over the hills north of Cincinnati, to Red Bank. The object of the road is to connect the roads entering the west end of Cincinnati with the roads entering the east end, by an independent local road that can be used for the benefit of any or all of the roads. It is to be controlled by local capital. The offices are in the St. Paul Building, Cincinnati, O. Henry Lewis is President and H. H. Tatem, Secretary and Treasurer.

Cincinnati, Washington & Baltimore.—The court at Cincinnati has decided that the prayer of the Baltimore & Ohio to have a judgment holds for \$1,250,000 declared a prior lien before some of the mortgages on the Cincinnati, Washington & Baltimore road must be granted. An order for the sale of the road will probably soon be issued, and it is thought that it will take place early next fall.

Cincinnati, Wheeling & New York.—The Receiver is now conducting negotiations for the building of the proposed extensions of this road, and if successful, they will be placed under contract and built this year. The proposed extensions are to be built from Morgan Junction to Freeport, and from Cumberland, O., to McConnellsville, a total distance of about 50 miles. J. W. Campbell, of Cambridge, O., is Receiver and General Manager.

Cornwall.—The location has been completed for the proposed southern extension from Mt. Hope to Lancaster, Pa., 14 miles. The maximum grade is 1.5 per cent., and the maximum curvature is 6 deg. This line, if built, would be slightly shorter than the Reading & Columbia, whose road is at present used under a trackage contract by the Cornwall road, between Mt. Hope and Lancaster. This line would join the Pennsylvania, on the Lancaster cut-off, and was made for the purpose of freight connection, but in the event of a final construction of this line, it will be necessary to make some arrangements with the Pennsylvania for a passenger terminal at Lancaster. Engineers are now running a location between Lebanon and Middletown, paralleling the Lebanon Valley branch of the Philadelphia & Reading between Lebanon and Hummelstown. This latter line will connect with the Pennsylvania at Middletown. The company expects to build one of these lines this year, but the final estimates have not yet been given. S. S. Neff, Lebanon, Pa., is General Superintendent.

Cumberland Valley.—Work is still progressing on the extension from Martinsburg, W. Va., to Winchester, Va., 22 miles, and it is now expected to have the line completed and in operation by July 1. Thirteen miles of the line will be in West Virginia and the rest in Virginia. The contractors on this extension are: Charles F. Wing and W. C. Wetherill, both of Winchester, Va., and Thomas F. Kerns and Thomas H. R. chert, both of Martinsburg.

Delaware & New England.—The company has applied to the Delaware Legislature for incorporation to secure a continuous rail route from Delaware to New England, without going through Jersey City, by consolidating the various short lines of road being formed to connect with the Poughkeepsie Bridge. The new route is to be from Dover, Del., over the Pennsylvania to Trenton, N. J., thence to Easton, Pa., and Poughkeepsie, N. Y.

Denison & Washita Valley.—The contract for bridging and tracklaying on this line has been let to Weed & Bradburn. As has already been stated, the contract for grading has been let to B. D. Corder and Dodson & Sturman. About five miles of the road is now completed, and it is expected to have 15 miles finished by May 1. The road is to be built from Denison, Tex., to Lehigh, I. T., and thence to Fort Smith, Ark. Of this, 75 miles in the Chickasaw and Choctaw Nation country has been located. H. W. Fox, of Denison, Tex., is Chief Engineer. The company will issue 40-year 6 per cent. bonds, at the rate of \$20,000 per completed miles of road, and secured by a first mortgage.

Duluth, Crookston & Northern.—This company, whose organization was recently noted, has filed a charter in Minnesota, giving it power to construct a road to commence at some point on Lake Superior, near the city of Duluth; thence in a westerly and northwesterly direction through the city of Crookston to the international boundary line or some point on the northern boundary line of Kittson County. Branch lines will be constructed from Crookston, one in a westerly direction through Polk County to the Red River, and another from Crookston southeasterly to the city of Brainerd. The amount of the capital stock is placed at \$5,000,000.

Durham & Northern.—The company has opened its line for business from Henderson, N. C., south to Creedmoor to Bennahan, a distance of 31 miles. The remaining 12 miles to Durham will also soon be opened. As already stated the line will form part of the Seaboard Air Line System.

Geneva & Van Ettenville.—This company has applied for a charter in New York to construct a road commencing at the easterly terminus of the proposed Buffalo & Geneva at or near the village of Geneva, and running thence by the most feasible route to a point on the Geneva, Ithaca & Sayre near Van Ettenville Station, an estimated distance of 60 miles. The capital stock is placed at \$600,000.

Georgia, Southern & Florida.—As stated last week the contract has been let for the construction of the line from Valdosta, Ga., to Lake City, Fla., a distance of 60 miles. Morgan & Reynolds have the contract for grading and E. W. Waters & Co. for ties. The contract for the construction of the section from Lake City to Palatka, Fla., will be let within the next 60 days. This line has already been located. Wm. Henry Wells, of Macon, Ga., is Chief Engineer.

Grafton & Upton.—The extension from Grafton Centre to West Upton, Mass., a distance of five miles, and which has been completed for some time, was opened for traffic this week.

Greenville & Southeastern.—This company has been incorporated in Alabama to build a road from Greenville, on the Louisville & Nashville, southeast to Andalusia, an estimated distance of 50 miles.

Hartsville.—This road, referred to last week, is being built from Hartsville to a point about five miles north of Darlington, S. C., a distance of about 10 miles. No contracts have been let, the work being done by people living along the line. J. L. Coker, of Hartsville, S. C., is president.

Hutchinson, Oklahoma & Gulf.—This company has been chartered in Kansas to build a road from Beloit south through the counties of Cloud, Mitchell, Ottawa, Lincoln,

Ellsworth, Saline, Rice, McPherson, Reno, Kingman, Harper and Barber, in the state of Kansas, and southerly through Oklahoma, and thence to the Gulf of Mexico. The estimated length of the road is 500 miles. The capital stock of the company is placed at \$6,000,000.

Milford & Lake Michigan.—This company has been chartered in Indiana with a capital stock of \$320,000, to build a road from Milford Junction to South Bend, an estimated distance of 40 miles.

Mississippi River & Mexican Gulf.—About 30 miles of this road has now been located north and south of Wesson, Miss., and it is stated that construction has been commenced at Wesson. Luther Sexton is General Manager.

Newberne & Uniontown.—The project of building this Alabama road, which has been dormant for some time, has again been taken up, and it is now stated that the early completion of the line may be expected.

New York, Pennsylvania & Ohio.—The second track is now completed between Youngstown and Leavittsburg, O., 17 miles, and work is in progress on the remaining 50 miles to Cleveland.

Norfolk & Western.—The company will let contracts this week for constructing 10 miles of road on the Clinch Valley division. Nearly 100 miles of this division has been let, and the first 30 miles have been completed. S. Walton, of Charleston, W. Va., had the contract for the first 25 miles, and Sexton & Houston, of Roanoke, Va., for the remaining five miles. Other contractors on this section are as follows: Henry & Davin, Lexington, Va., between 31st and 38th mile; J. P. Cash, Liberty, Va., for next three miles; McGraw & Stewart, of Lancaster, Pa., for next 21 miles; McMahon, Green & Son, of Witheville, Va., and George T. Mills, Pulaski, Va., for the remainder of the division. In this last section there are 5 tunnels, and the contracts for most of them have also been let to George T. Mills. There are 7 tunnels on the line over 1,000 ft. long, and four under 1,000 ft. The principal ones are at Kenwood, 1,080 ft. long, and at Little Iron, 1,000 ft. long. There are 4 trestles, each 140 ft. high; one is 500 ft. long, one 537 ft., and two 612 ft. long. The contracts for bridging and trestling on the first 65 miles has been let to Cofredo & Evans, and they have completed all bridges on the first 25 miles. The road is now completed for some distance beyond Tazewell C. H., Va., and it is expected that Cedar Bluffs will be reached by July 1, and that 50 miles of road will be finished by Nov. 1.

Old Colony.—The Railroad Committee has reported to the Massachusetts House a bill authorizing the Old Colony Road to increase its capital stock by \$3,000,000.

Omaha, Dodge City & Southern.—The contract for the construction of this road from Dodge City, Kan., northeast to Superior, Neb., has been let to J. W. Summers & Co., of Keokuk, Ia. The line will be 100 miles long, and it is expected to have the work completed by next December. C. E. Gallagher, of Dodge City, is Vice President and Chief Engineer.

Paxton & Eastern Illinois.—This company has been incorporated in Illinois to build a road from Paxton northeast to a point at or near the boundary line between Illinois and Indiana, north of the line of the Toledo, Peoria & Warsaw road, where it is proposed to connect with another road running to Chicago. The capital stock is \$750,000, and the principal office will be in Paxton, Ford County.

Pennsylvania.—It is stated that the company has secured possession of 3,660 ft. of shore front on New York Bay, and that it has also purchased a large section of contiguous property, and that a railroad terminal is to be constructed on the property. The property forms a stretch over 3,500 ft. in length, with about 50 acres of upland and 420 acres under water. The extremity of the tract lies about a mile behind the Liberty statue, and two miles from the Battery. The purchase gave the company the right to acquire from the state the lands under water facing the tract, and it is stated a grant has already been secured at a cost of \$100,000. The area from the shore to the present exterior pier line covers 420 acres.

Pennsylvania, Poughkeepsie & Boston.—This road has now been completed from Pine Island, Orange County, N. Y., southwest through Deckertown to Augusta, Sussex County, N. J., a distance of 18 miles. Work is now in progress on the line from Augusta through Portland to Slatington, Pa., a distance of 59 miles. The road connects at Pine Island with the New York, Lake Erie & Western, at Deckertown; with the New York, Susquehanna & Western, at Augusta, and with the Delaware, Lackawanna & Western.

Philadelphia & Reading.—The company has let the contracts for widening the tunnels on its main line at West Manayunk and Phoenixville. This improvement is the last necessary to allow the clear passage over the entire road of the new passenger cars and freight cars of standard width and height and the new anthracite-burning locomotives now in use on the lines.

Pittsburgh & Western Express.—This company, which operates over the Pittsburgh & Western Railroad, has passed into the control of the Wells Fargo Express Co., and its business will hereafter be conducted by that company, which will thus secure an entrance to Pittsburgh, and to many important points in Ohio and Pennsylvania.

Port Jervis, Monticello & New York.—The suit brought by this company against the New York, Lake Erie & Western, to compel the latter to furnish the former terminal facilities at Port Jervis without charge and for \$14,000 damages for refusing to do so, was decided this week in favor of the Erie. The claim made by the Monticello Company was that before the construction of that road an agreement was made between its officers and those of the Erie Company, that the new company might use tracks and other facilities of the latter at Port Jervis without any charge, and that the road was built on the faith of such agreement. The only proof of this agreement furnished was the statement that the officers of the Erie, in 1868, had verbally offered the road the free use of the terminal facilities in Port Jervis. No record of the agreement could be shown, and the case was dismissed, and the Port Jervis, Monticello & New York was allowed 60 days in which to apply for a commission to fix the terms on which they might connect with the Erie, but if they did not move in that time, the Erie might sever the connection. The court also decided that the use of the tracks during the time since the road ceased paying should be paid for by the Monticello Company, and found that such use was worth the increased amount charged by the Erie, \$300 a month.

Port Royal & Augusta.—The case against the Port Royal & Augusta Company, the Central of Georgia, the Georgia Company and the Terminal Company, brought by certain bondholders of the original Port Royal Company, asking an injunction and seeking to break the leases of the Central Railroad and others upon the Port Royal & Augusta Railroad, was last week dismissed, pending argument on an

injunction before the Superior Court. The case was dismissed by complainants in accordance with the terms of settlement agreed on between the parties.

Providence & Norwich.—A bill has been introduced in the Rhode Island Legislature to incorporate a company of this name in that state to build at Rhode Island, which is to form part of another new route from Boston to New York. As projected, the line in Connecticut will pass north of Bridgeport and New Haven, and will extend from Norwich to Middletown, and thence southeast.

Raritan River.—The company has made a mortgage on its new road in favor of the Holland Trust Co., of New York, to secure an issue of bonds to the amount of \$400,000. The road is now completed from South Amboy toward New Brunswick, N. J., for about 10 miles, and work is in progress on the rest of the line.

St. Joseph Belt.—A company has been formed with a capital stock of \$500,000 by S. S. Sharp, of Kansas City, Mo., and others, to build a road from the stock yards south of St. Joseph, Mo., to the city's eastern limits and thence to the northern city limits to connect with the Union street railway.

St. Louis & Chicago.—Upon the application of F. C. Hollins & Co., of New York, the New York Supreme Court has granted an attachment against the property in New York of the company in a suit to recover a claim of \$58,933. The plaintiffs aver that they have been the fiscal agents for the company in New York for some time, and since Nov. 1, 1887, have advanced and loaned to the defendants at their request \$107,817, of which but \$48,883 has been paid.

Salt Lake City & Eastern.—Press dispatches state that at a meeting in Sioux City this week between the Sioux City stockholders and Mr. Gedney, Donald McLean and other New York parties interested in the company made a deposit of \$1,000,000, to be used by the construction company. The New York parties deposited \$600,000 and the Sioux City men \$400,000. L. A. Wakefield, of Sioux City, was selected Assistant Engineer, and will start over the line, which has been located and cross-sectioned for 150 miles westward. Contracts will be let within 40 days for constructing the first 100 miles. The road is being built by the Wyoming Improvement Co., who have an office at 120 Broadway, New York.

Salt Lake, Nevada & California.—According to the announcement in these columns, the contract for grading 20 miles of this road was let last week. The contract for the first 10 miles west from Salt Lake City to John Powell, of Salt Lake; the second section of 10 miles was let to A. Adamson, of Lake Point, Utah. Work is to begin immediately and is to be completed by June 15. Theodore Brown, of Salt Lake, is Secretary of the company.

San Gabriel Valley Rapid Transit.—The branch of this road from Ramona to Pasadena, Cal., has been graded and the contract for track laying has been let to Monroe & Armstrong, of Monrovia, Cal., who will soon commence work. The road is now built and equipped from Los Angeles to Monrovia, Los Angeles County, Cal., 17½ miles, through East Los Angeles, Ramona, Alhambra, East San Gabriel, Roses, Chapmans, Baldwin and Arcadia. The stockholders of the company have recently authorized the issue of six per cent. bonds to the amount of \$250,000, the proceeds to be used in improving the road and building extensions.

Sante Fe Southern.—The name of the Texas, Sante Fe & Northern has been changed to the above, and the road will hereafter be operated under that name. It extends from Sante Fe to Espanola, N. M., 40 miles.

Tacoma & Lake City.—This company has been incorporated in Washington Territory to build a road from Tacoma to a point on American Lake. The capital stock is \$1,000,000.

Topeka, Westmoreland & Marysville.—This company has been chartered in Kansas to build a road from Topeka, northwesterly through Shawnee, Pottawatomie and Marshall Counties, to the north line of Marshall County, a distance of about 150 miles. The capital stock is placed at \$1,000,000.

Topolobampo.—Richard Klegg & Co., of Ottawa, Ohio, have been awarded the contract for building this road from Guaymas, State of Sonora, Mexico, southeast about 220 miles to Topolobampo Bay, in the state of Sinaloa. Guaymas is the southern terminus of the Sonora road of the Atchison, Topeka & Santa Fe. The contractors expect to begin work about April 1. The headquarters in Mexico will be at Guaymas.

Union Pacific.—At a recent meeting of the directors a plan for the consolidation of the branch lines centering in Ogden was decided upon. The consolidated company will probably be known as the Oregon Short Line & Utah Southern Railroad Company. It will operate 1,055 miles of railroad between Granger and Ogden on the south and Huntington and Butte on the north and west. The gross income of the two lines composing the consolidated company for the year 1888 was \$4,775,000. Their operating expenses were \$2,850,000. Net revenue was \$1,925,000, or \$55,000 above fixed charges, etc. The question of incorporating with this company the other Utah lines of the Union Pacific system is also under consideration. There are four of these companies—the Utah Central, operating 280 miles; the Utah & Nevada 37 miles; the Salt Lake & Western, 58 miles, and the Ogden & Syracuse, six miles.

Virginia Western.—A contract for building 10 miles of this road from New River, Montgomery County, up Thomas Creek, has been let to D. S. Pitzer, and he has commenced work. The grading is light. Col. A. S. Buford is President, and H. D. Whitcomb is Chief Engineer, both of Richmond, Va.

Wabash.—The Chicago division of the Wabash, now under the control of Receiver John McNulta, was sold to the Purchasing Committee in Chicago, March 11, for \$3,500,000. This line extends from Altamont and Effingham to Streator and from Streator to Chicago, about 258 miles. This is considered the first step toward consolidating the Eastern and Western divisions. The legal steps necessary to organize the remaining divisions, composed of the main line from Toledo to Hannibal and from Decatur to Hannibal, and from Decatur to St. Louis, will be taken on March 21. Should the sales of all the divisions be confirmed, the entire system east of the river will be in the hands of the Purchasing Committee on May 1, and under control of the Wabash Western June 1. This will add to the Wabash Western 956 miles of road and will reunite under one management the two divisions separated Jan. 1, 1887. It is about five years since the Wabash road entered bankruptcy, the entire system passing into the Receiver's hands June 1, 1884. The Wabash Western emerged June 1, 1887, and the lines will be freed before June 1 next. The main lines of the Wabash east of the Mississippi River, not including the Chicago division, comprise roads from Toledo westward, through Ohio and Indiana to Decatur, Ill., from Decatur to Mediana and

Naples, from Naples to East Hannibal, from Mediana by Clayton to Camp Point, from Clayton to Elvaston and from Edwardsville to Edwardsville Junction. Total, 652 miles. After all the divisions have been brought in by the Purchasing Committee, the entire system east of the river will be turned over to the Wabash Western and operated by the officers of that road.

Western Maryland.—The company has applied to the Baltimore City Councils for permission to lay tracks connecting with the Baltimore & Ohio tracks at Locust Point and extension to tidewater. The company has heretofore been using the Pennsylvania tidewater terminals and tracks on the east side of the harbor.

Wilmington & Weldon.—The extension of the Albemarle & Raleigh from Williamston easterly through Janelville to Plymouth, N. C., a distance of 24 miles, has been all graded from Williamston to Janelville. Tracklaying has not yet been commenced but will soon be.

TRAFFIC AND EARNINGS.

Traffic Notes.

The Connecticut Sunday Railroad law has been amended by providing that the Railroad Commissioners may suspend the operation of section 3,524 so as to permit the handling, loading or unloading of freight by transfer of said freight between steamboats and cars, until 8 o'clock in the forenoon of Sunday at any depot or station where, upon application made to them, they shall find that the same is required by the public necessity or for the preservation of freight.

The trunk lines have been ordered to send representatives to a meeting in Washington on March 16 to discuss the whole subject of export rates.

The Inter-state Commerce Railway Association.

The general managers of the lines of this Association have unanimously agreed to the plan of organization, which comprises three freight associations, to be called respectively the Northwestern, Southwestern and Trans-Missouri Divisions, and one additional passenger association, the latter to cover territory west of the Mississippi River, and now included in the Western States Passenger Association. Each subdivision of the association will make rates over the entire lines on the business it originates. The Board of Managers met in Chicago on Wednesday and agreed upon the outlines of the territory to be covered by the auxiliary associations, under the Presidents' Agreement. The Western Freight Association, with its several divisions, will continue as at present, while the Trans-Missouri Association will embrace all the territory west of the Missouri River.

The Amended Inter-state Commerce Law.

The Inter-state Commerce Commission has issued to the railroads a circular announcing the amendments to the law which were passed March 2, and stating that copies of the law as amended will be furnished on application. The circular says that the periods prescribed by law for notices of advance or reduction of tariffs are to be computed from the day when the notice of advance or reduction reaches the office of the Commission in Washington. It continues:

The transportation of passengers or freight over continuous lines or routes operated by more than one carrier, upon through tickets or through billings, necessarily implies the existence of joint tariffs. All joint tariffs now filed in the office of the Commission will be understood as remaining in force until due notice of advance or reduction is given. When no other tariff is filed the rates on joint traffic are understood to be the sum of the local rates of the individual roads.

An order has been made prescribing that all future advances and reductions in joint tariffs shall be given the same publicity which is required in the case of tariffs of individual carriers. Until such advances or reductions are notified to the Commission, and made public, existing joint tariffs, as above defined, must be observed. * * * It is now an indictable offense for any carrier to participate in the reception of compensation above or below the established rate for the transportation of any joint traffic whatsoever. This provision operates to prevent discrimination among shippers, and in case of its violation proof can readily be made. * * * The effect of the amendments is to place joint tariffs and individual tariffs under substantially the same rules. Neither can be reduced without three days' public notice, or advanced without ten days' public notice, and the Commission must also be notified of all contemplated changes; individual and joint tariffs alike must be observed in their integrity, and all inter-state traffic is necessarily accepted under either an individual tariff or a joint tariff.

In reference to the application of these provisions of the law to export traffic, the Commission understands that tariffs now on file in its office, established by carriers accepting merchandise billed or intended for export by sea, show the rate charged by the inland carrier or carriers to the point of export, with a notation to the effect that the through rate is determined by the addition of the ocean rate from time to time prevailing. The law contemplates that all traffic from inland points designed for export by sea must be taken under a joint tariff or an individual tariff; the tariffs above referred to as now on file embrace both classes. Under these tariffs the inland rate to the point of export cannot be varied without subjecting the carrier to the penalties imposed for violation of the law.

Ticket Commissions.

The trunk lines have placed on sale tickets over the Chicago & Alton which were withdrawn two years ago in consequence of the refusal of that road to agree not to pay commissions in eastern territory. It will be remembered that the Baltimore & Ohio resumed the sale of these tickets several months ago. The Chicago & Alton has not changed its position, and the cause of the present action is not apparent. The Trunk lines have undoubtedly resolved to make a hard fight for the final abolition of commission payments, and have perhaps made this move for the purpose of removing all possible ground for charges of discrimination against them. Besides, the Trunk lines themselves have paid commissions on emigrant tickets, and perhaps others, and their position was perhaps not as sound as could be desired. A resolution has been passed to discontinue emigrant commissions March 20, and the purpose not to pay commissions anywhere on anything has been reaffirmed by the Joint Executive Committee of the Trunk lines and the Central Traffic Association.

The following letter, dated Feb. 27, from Chairman Cooley, of the Inter-state Commerce Commission, to George H. Daniels, Chairman of the Passenger Department of the Central Traffic Association, has been made public:

I understand that the railroad companies at Chicago are beginning to pay commissions again. I have only to say on this subject at this time that if that course is adopted and persisted in, it will be necessary that it be taken up at a public hearing in Chicago, in which the question to be presented will be of the reduction of the passenger tariffs of all the roads paying commissions to the extent of the commissions they are found to be paying. It will be very well for the managers of these roads to consider what the

inevitable effect of such an investigation must be. With what face they can contend against legislation for the reduction of their rates when they themselves are reducing them in this indirect way, and in a way, too, that results in a much greater reduction of their revenue than the actual amount paid out for commissions would indicate, is more than I can understand. At any rate, I desire that they should keep clearly before them in what they do now a consequence that may speedily be upon them. If they want to resuscitate the business of the scalpers with all its rascalities and all its losses to themselves, they can, of course, do it, but they should be prepared to take the consequences that may follow from unfriendly legislation, as well as from the action of other public authorities.

Railroad Earnings.

Earnings of railroad lines for various periods are reported as follows:

PRESCOTT & ARIZONA CENTRAL.				
The statement for February shows:				
	1888.	1888.	Inc. or Dec.	
Gross earnings.....	\$8,874	\$8,510	I.	\$1,363
Oper. expenses.....	3,670	3,106	I.	564
Net earnings.....	\$5,204	\$5,404	I.	\$799

CAIRO, VINCENNES & CHICAGO.

The statement for January shows:				
	1888.	1888.	Inc. or Dec.	
Gross earnings.....	\$54,064	\$56,452	D.	\$2,388
Oper., exp. & taxes.....	38,961	41,951	D.	5,990
Net earnings.....	\$15,103	\$15,501	I.	\$3,602

MISSOURI PACIFIC.

Year to Dec. 31:				
	1888.	1887.	Inc. or Dec.	
Gross earnings.....	\$12,378,642	\$12,979,589	D.	\$600,947
Oper. expenses.....	9,411,979	8,286,594	I.	1,125,385
Net earnings.....	\$2,966,663	\$4,692,995	D.	\$1,726,332
Other income.....	1,041,375	3,014,261	D.	1,972,886
Total.....	\$4,008,038	\$7,707,256	D.	\$3,699,218
All charges.....	3,111,720	3,111,670	I.	465,570
Balance.....	\$430,798	\$4,595,586	D.	\$4,164,788
Dividend.....	2,208,679	3,008,174	D.	1,799,495
Deficit.....	\$1,777,881	\$1,587,412	I.	\$3,365,293

ST. LOUIS, IRON MOUNTAIN & SOUTHERN.

Year to Dec. 31:				
	1888.	1887.	Inc. or Dec.	
Gross earnings.....	\$8,084,647	\$8,331,822	D.	\$247,175
Oper. expenses.....	5,090,032	4,848,429	I.	241,603
Net earnings.....	\$2,994,615	\$3,483,393	D.	\$488,778
Other income.....	60,239	118,501	D.	58,262
Total income.....	\$3,054,854	\$3,601,894	D.	\$547,040
All charges.....	2,816,303	2,946,753	D.	130,450
Surplus.....	\$238,551	\$655,141	D.	\$416,590
Dividend (5 p. c.).....		1,103,695	D.	1,103,695
Deficit.....		\$448,554	D.	\$448,554

Month of January:				
	1888.	1888.	Inc. or Dec.	P. c.
Bur., Ced. Rap. & N.	\$205,628	\$208,245	D.	1.2
Net.....	50,890	31,981	I.	18.91
Chn., N. O. & Tex. P.	319,378	277,626	I.	15.2
Net.....	121,000	71,785	I.	49.25
Flint. & Pere Marq.	293,778	194,396	I.	9.32
Net.....	49,804	31,182	I.	18.62
Ill. Cen. (Ill. & So. D.)	983,852	957,803	I.	36.04
Net.....	330,918	263,410	I.	67.58
Louis., N. O. & Tex.	256,609	241,528	I.	15.80
Net.....	81,034	81,081	D.	47
New Brunswick.....	48,621	46,309	I.	12.31
Net.....	13,541	5,941	I.	7.60
N. O. & Northeast.....	100,804	75,049	I.	25.75
Net.....	30,000	19,000	I.	57.8
N. Y., Ont. & West.	112,415	107,572	I.	4.83
Net.....	5,100	3,656	I.	14.44
Ohio & Mississippi.....	318,922	304,827	I.	14.05
Net.....	102,232	85,503	I.	16.29
Ore. Imp. Co.....	298,638	342,879	D.	44.21
Net.....	12,400	38,906	D.	51.30
Philadelphia & Erie.....	228,744	225,744	I.	13.83
Net.....	38,464	52,147	D.	35.5
Pitts. & Western.....	169,390	142,853	I.	26.76
Net.....	47,590	48,561	D.	971
Tol. & Ohio Central.....	81,456	108,212	D.	26.76
Net.....	22,566	43,032	D.	20.46
Vick. & Mer.....	56,853	46,065	I.	787
Net.....	25,000	5,000	I.	22.00
Vick., Sh. & Pac.....	56,624	47,252	I.	9.32
Net.....	12,000	10,000	I.	20.0
Total (gross).....	\$3,491,747	\$3,324,361	I.	\$167,386
Total (net).....	917,778	789,185	I.	128,593

Cotton.

The cotton movement for the week ending March 8 is reported as follows in bales:

Interior markets:				
	1888.	1888.	Inc. or Dec.	P. c.
Receipts.....	46,229	30,851	I.	15.378
Shipments.....	71,199	52,931	I.	18.268
Stock.....	246,002	302,508	D.	56,506
Seaports:				
Receipts.....	81,638	73,469	I.	8.169
Exports.....	148,053	87,594	I.	60.549
Stock.....	740,278	797,010	D.	56,732

Coal.

The Cumberland coal trade for the week ending March 9, amounted to 47,456 tons, and for the year to that date 477,564 tons.

East-bound Shipments.

The shipments of east-bound freight from Chicago by all the lines for the week ending Saturday, March 9, amounted to 70,449 tons, against 65,345 tons during the preceding week, an increase of 5,104 tons, and against 54,022 tons during the corresponding week of 1888, an increase of 16,427 tons. The proportions carried by each road were:

	W'k to Mar. 9.		W'k to Mar. 2.	
	Tons.	P. c.	Tons.	P. c.
Michigan Central.....	5,520	7.8	5,891	9.0
Wabash.....	7,200	10.2	6,971	10.7
Lake Shore & Michigan South.	7,531	10.7	7,259	11.1
Pitts., Ft. Wayne & Chicago.....	7,125	10.1	6,401	9.8
Chicago, St. Louis & Pitts.....	9,002	12.8	11,107	17.0
Baltimore & Ohio.....	3,227	4.6	3,309	5.1
Chicago & Grand Trunk.....	16,401	23.3	13,139	20.1
New York, Chic. & St. Louis.....	6,522	9.3	6,264	9.6
Chicago & Atlantic.....	7,921	11.2	5,004	7.6
Total.....	70,449	100.0	65,345	100.0

Of the above shipments 4,329 tons were flour, 33,600 tons grain, 3,291 tons millstuff, 4,706 tons cured meats, 4,052 tons lard, 8,280 tons dressed beef, 346 tons flaxseed, 951 tons butter, 1,633 tons hides, 210 tons wool, and 4,846 tons lumber. The three Vanderbilt lines together carried 27.8 per cent. of all the shipments, while the two Pennsylvania lines carried 22.9 per cent.